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ENGINEERING SOILS MAP OF WARREN COUNTY, INDIANA

JULY 1970 — NUMBER 14

BY

P. T. YEH

JHRP

JOINT HIGHWAY RESEARCH PROJECT

PURDUE UNIVERSITY AND

INDIANA STATE HIGHWAY COMMISSION

Final Report

ENGINEERING SOILS MAP OF WARREN COUNTY, INDIANA

To: Dr. J. F. McLaughlin, Director
Joint Highway Research Project

July 16, 1970

File: 1-5-28-50

From: H. L. Michael, Associate Director
Joint Highway Research Project

Project: C-36-51 B

The attached report, entitled "Engineering Soils Map of Warren County, Indiana", completes a portion of the project concerned with development of county engineering soils map of the state of Indiana. This is the 50th report in the series. The report was prepared by Dr. P. T. Yeh, Research Engineer, Joint Highway Research Project.

The soils mapping of Warren County was done primarily by air-photo interpretation. Some test data along US 41 and SR 63 provided by the Indiana State Highway Commission and the boring data of the proposed Big Pine Creek Reservoir prepared by the Corp of Engineers, U. S. Army Engineering District, Louisville, are included in the report. Generalized soil profiles of the major soil groups are presented on the engineering soils map. An ozalid print of the Engineering Soils Map of Warren County is included in the report.

Respectfully submitted,

Harold L. Michael

Harold L. Michael
Associate Director

HLM/lm
Attachment

cc: F. L. Ashbaucher
W. L. Dolch
W. H. Goetz
W. L. Grecco
G. K. Hallock
M. E. Harr
R. H. Harrell
V. E. Harvey
M. L. Hayes
G. A. Leonards
E. M. Miknail
R. D. Miles
C. F. Scholer
M. B. Scott
W. T. Spencer
H. R. J. Walsh
K. B. Woods
E. J. Yoder

Final Report

ENGINEERING SOILS MAP OF WARREN COUNTY, INDIANA

by

P. T. Yeh
Research Engineer

Joint Highway Research Project
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Purdue University
Lafayette, Indiana
July 16, 1970

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All airphotos used in connection with the preparation of this report automatically carried the following credit lines: Photographed for Commodity Stabilization Service, Performance and Aerial Photography Division, United States Department of Agriculture.

AIRPHOTO INTERPRETATION OF ENGINEERING SOILS OF WARREN COUNTY, INDIANA

by

P. T. Yeh

INTRODUCTION

The Engineering Soils Map of Warren County, Indiana which accompanies this report was compiled from 9" x 9" aerial photographs having an approximate scale of 1:20,000. The aerial photographs were taken in July and August of 1950 for the United States Department of Agriculture and were purchased from that agency.

Aerial photographic interpretation of the land forms and engineering soils of this county was accomplished in accordance with accepted principles of observation and inference (1)*. Field trips were made to the area for the purposes of resolving ambiguous details and correlating aerial photographic patterns with soil textures. Standard mapping symbols developed by the staff of the Airphoto Interpretation Laboratory, School of Civil Engineering, Purdue University, were employed to delineate land forms and soil textures. The text of this report largely represents an effort to overcome the limitation imposed by adherence to a standard symbolism and map presentation.

Although no soil samples were collected and tested by the Joint Highway Research Project, general soil profiles were developed and are shown on the soils map. The soil profiles were compiled from the agriculture literature, information from the adjacent counties, from the boring data of proposed Big Pine Creek reservoir and from the boring data of the roadway soil survey along US 41 and SR 63 supplied by the State Highway Commission.

* Figures in parentheses refer to references appearing in the bibliography.

Liberal reference was made to "The Formation Distribution and Engineering Characteristics of Soils" (2), "Soil Survey of Warren County, Indiana" (3), "Soil Study of Warren County, Indiana (4), "Vermillion County Soils" (5), and the Engineering Soils Map of Benton and Tippecanoe Counties, Indiana (6,7).

DESCRIPTION OF AREA

General

Warren County is located in the west-central part of Indiana (Fig. 1). The western boundary of the county is the Illinois-Indiana State line. Warren County is 23 miles wide (east-west) with a maximum length of 24 miles (north-south). Warren County has a total area of 368 square miles or 235,520 acres (8). Williamsport is the county seat and is located near the center of the southern border along the Wabash River. A population of 8,545 inhabitants resided within the county in the 1960 census (9).

According to the 1964 Census of Agriculture, 86.6% of the area of Warren County was farmland (10). There were 20,450 acres of wooded land in the county (10) which was generally confined along streams and rivers as shown in Fig. 2.

Drainage Features

Warren County lies within the drainage basin of the Wabash River. Although the northwestern and some of the western part of the county drain into Illinois, the water from these areas eventually reach the Wabash River. Big Pine Creek, a major tributary of the Wabash River is deeply entrenched in the county. The shape of the stream reveals bedrock control in many places (Fig. 3). Little Pine Creek, Kickapoo Creek, Rock Creek, Mud Run Creek and Possum Creek are the other tributaries. All have deep valleys near the Wabash River. Bedrock is exposed in many places along the valley

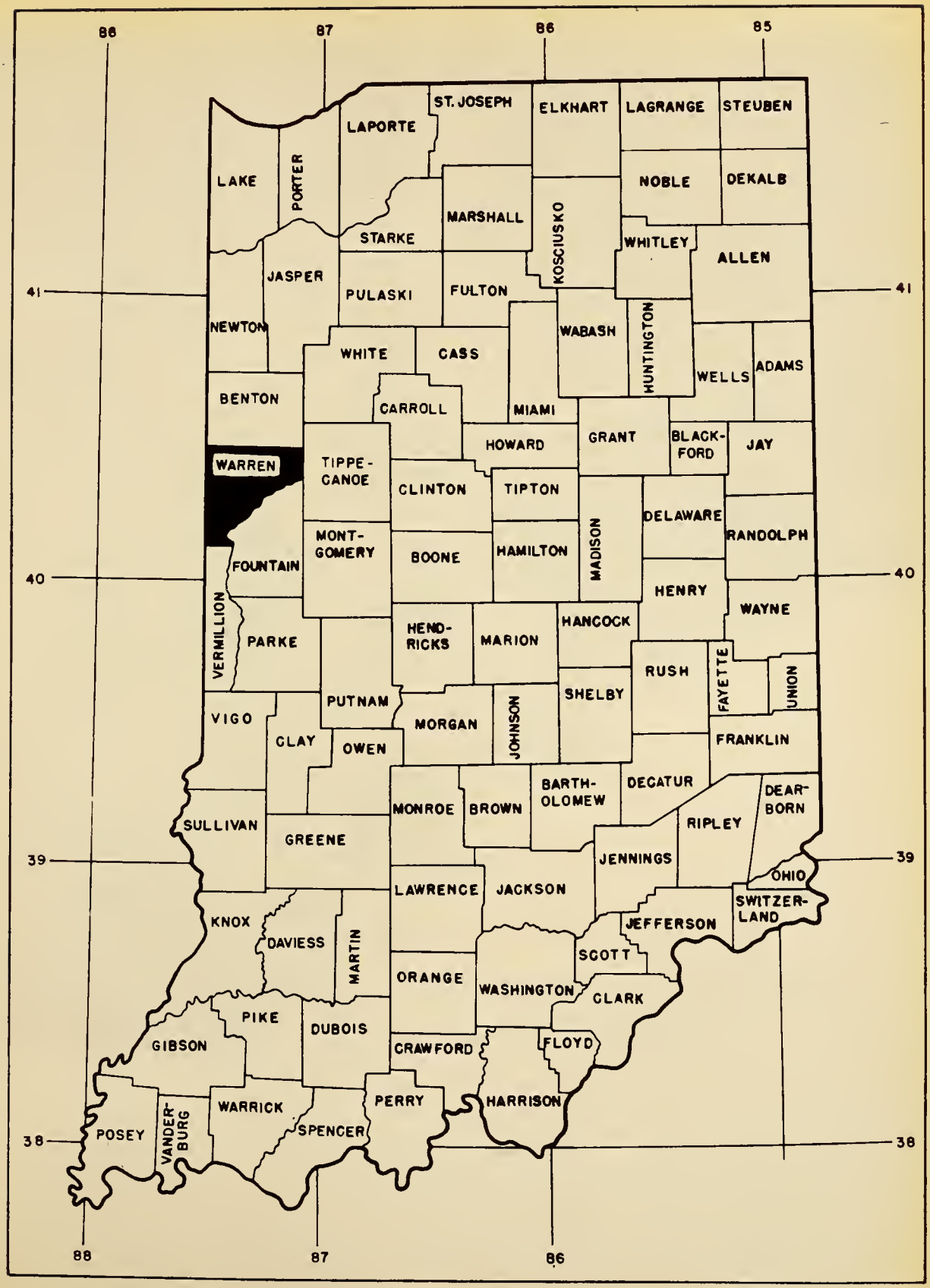


FIG. I LOCATION MAP OF WARREN COUNTY

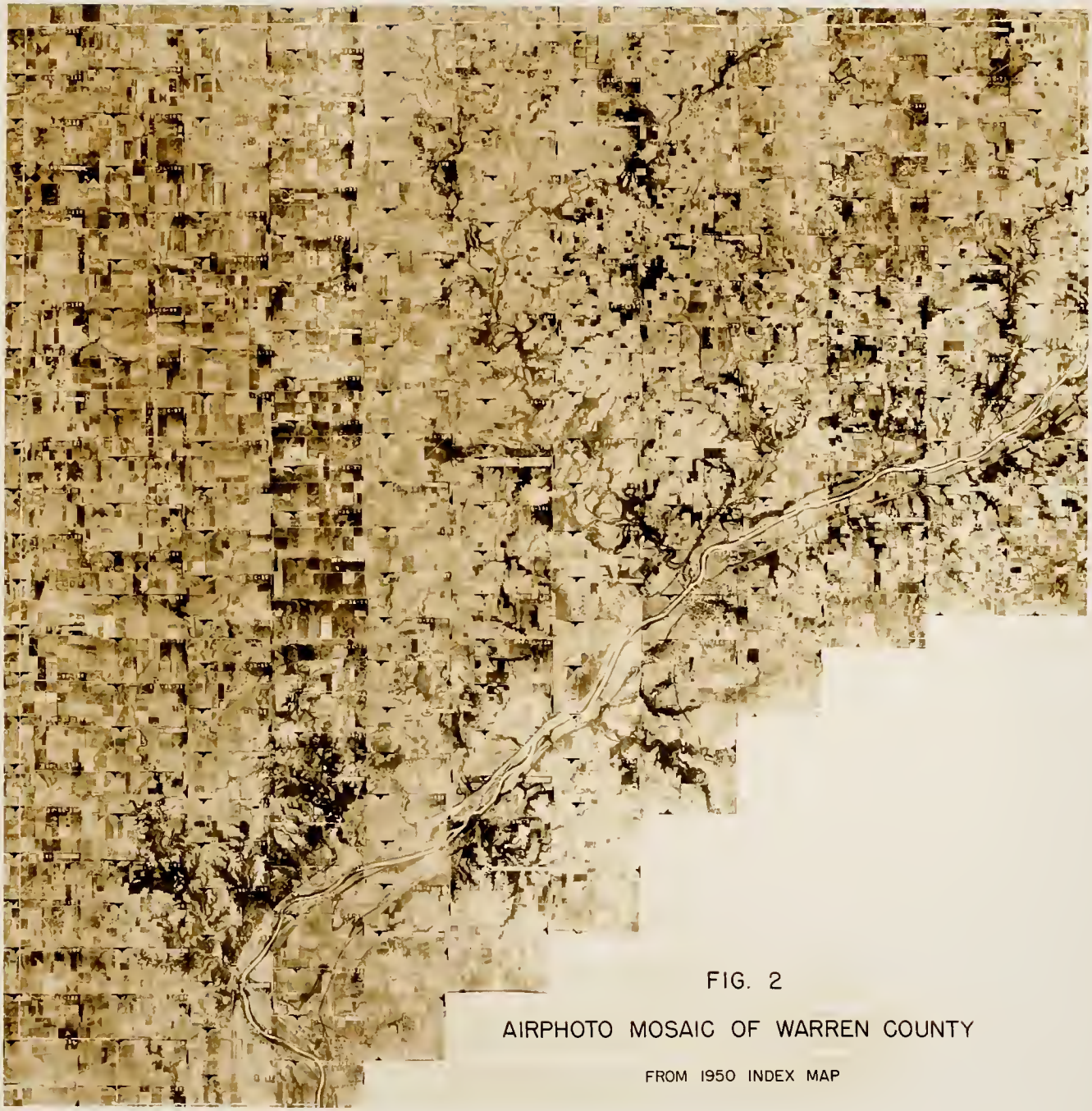


FIG. 2

AIRPHOTO MOSAIC OF WARREN COUNTY

FROM 1950 INDEX MAP

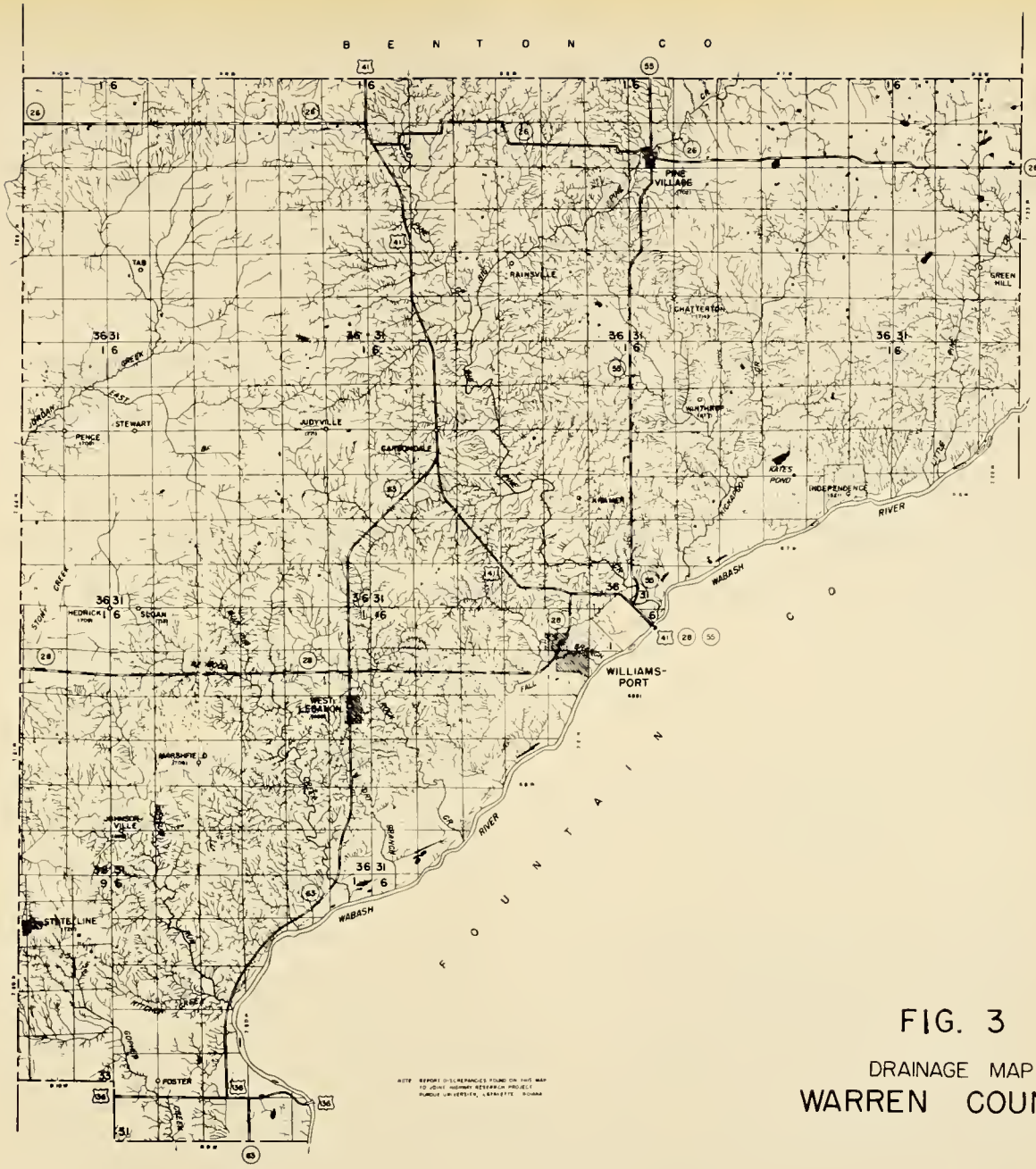


FIG. 3

DRAINAGE MAP

WARREN COUNTY

walls and occasionally the streams flow on rock. Several small waterfalls occur in Warren County. The highest one (60-70 ft. fall) is located near Williamsport along Fall Branch.

The principal surface drainage system is well developed throughout the county. There are, however, many ditches and dredged streams on the upland to improve the sluggish drainage condition of the nearly level regions particularly in the northwestern quarter of the county. Infiltration basins and kettles are concentrated in the northeastern and the northwestern portions of Warren County. There are a few ponds scattered around the county. Most are located in the northwestern part of the county. The largest, Kates Pond, is located one and one-half miles northwest of Independence.

Climate

The climate of Warren County is continental, humid, and temperate. The warm humid and moderately cold winters are characterized by frequent sudden changes of temperature.

Warren County has no operating climatological station. However, 11 years of data collected in Judyville shows an annual precipitation of 34.69 inches (11). Maximum and minimum temperatures of 104 and -23 respectively were recorded during this period. For a more reliable value the reader should consult the long climatological data collected in the surrounding counties, i.e. Fowler in Benton County, West Lafayette in Tippecanoe County and Crawfordsville in Montgomery County.

Physiography

Warren County lies within the Tipton Till Plain Physiographic region of the State (Fig. 4). With respect to its physiographic situation in the United States, the county is a part of the Till Plain Section of the Central Lowland Province (12).

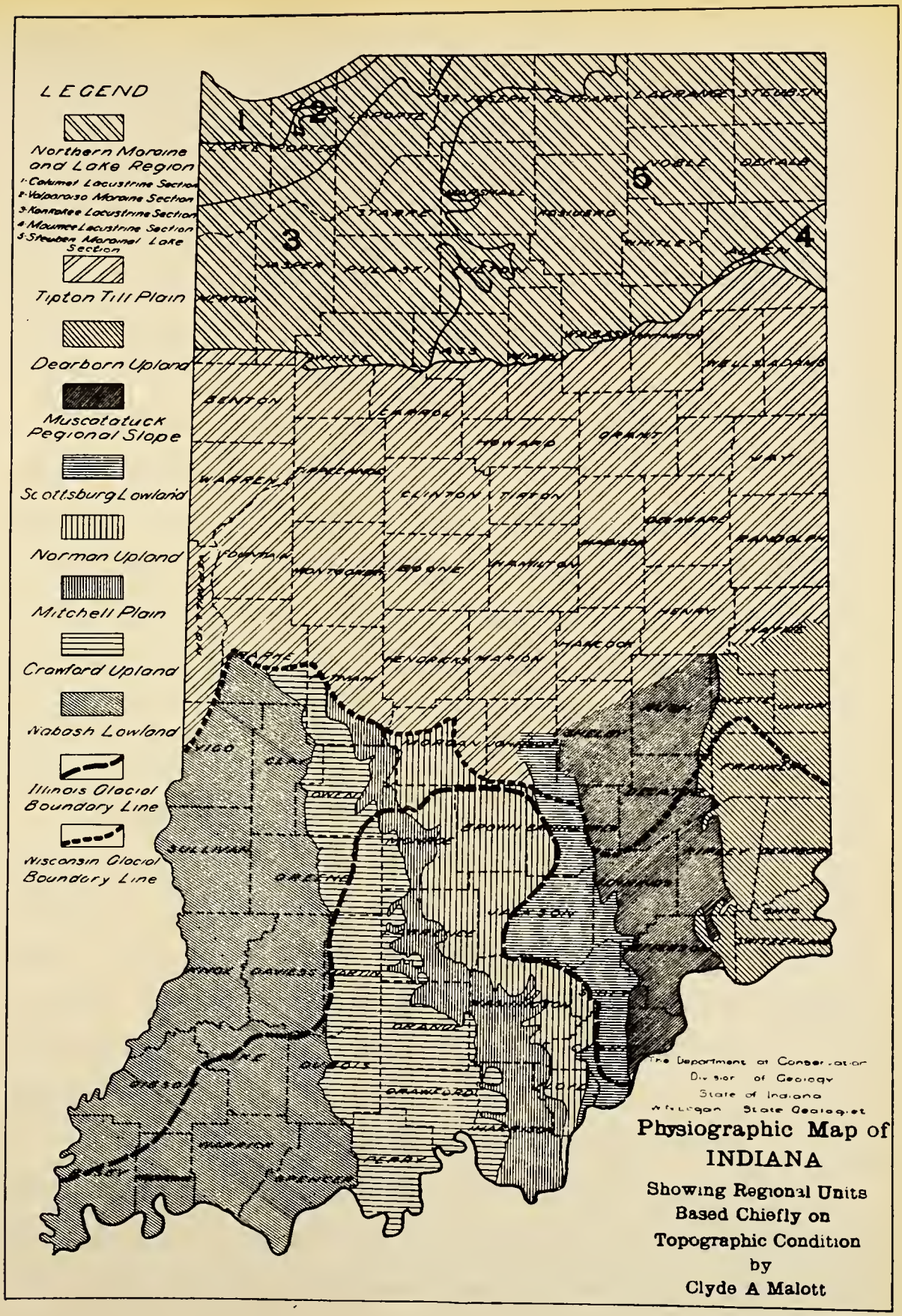

LEGEND
Northern Moraine and Lake Region
1-Calumet Lacustrine Section
2-Valparaiso Moraine Section
3-Kankakee Lacustrine Section
4-Maumee Lacustrine Section
5-Steuben Morainal Lake Section
Tipton Till Plain
Dearborn Upland
Muscatatuck Regional Slope
Scottsburg Lowland
Norman Upland
Mitchell Plain
Crawford Upland
Wabash Lowland
Illinois Glacial Boundary Line
Wisconsin Glacial Boundary Line
The Department of Conservation
Division of Geology
State of Indiana
W. S. Logan State Geologist
Physiographic Map of INDIANA
Showing Regional Units Based Chiefly on Topographic Condition
by
Clyde A Malott

FIG. 4

Topography

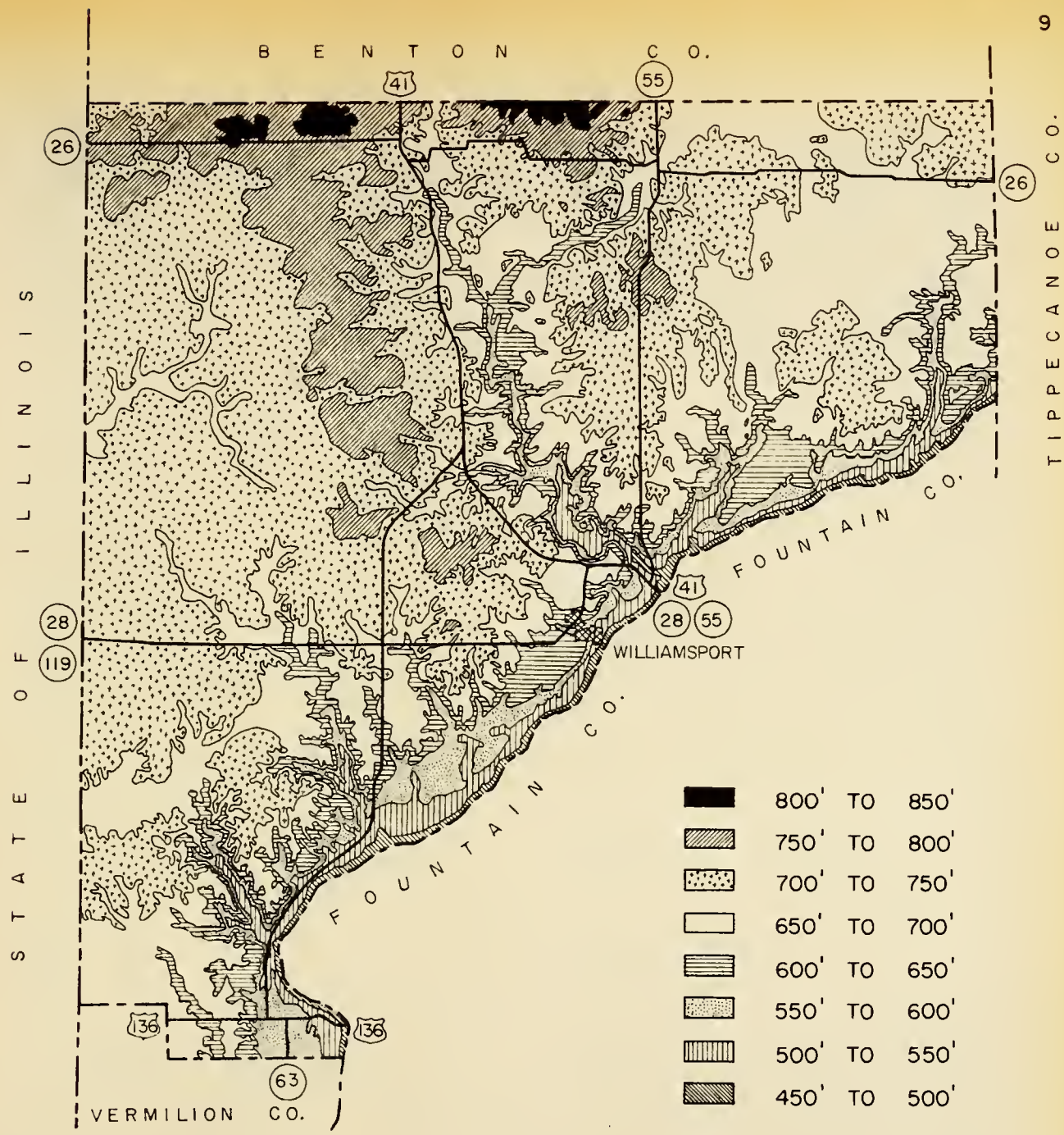
Physiographically Warren County is a plain of low relief. Topographically it consists of undulating prairie plains and a belt of low hilly or rolling end moraines as shown in Fig. 5. The largest undulating plain is located in the west-central portion of the county. The second largest one is situated in the northeastern portion of the county. A small plain occurs also at the southwestern corner of Warren County.

The highest elevation (about 830 ft.) is located on the end moraine near the Benton County border about five miles northeast of Tab. The lowest point (about 480 feet) occurs on the Wabash River at the point where it leaves the county. Maximum local relief of about 150 feet is found along the deep and tortuous valley of Big Pine Creek and at Black Rock where the Wabash River enters the county from Tippecanoe County. Relief of 100 feet or more is common along the valleys of the major streams of Warren County (Fig. 5).

Regions bordering the major streams and tributaries are extremely rugged. The deeply dissected gullies greatly enhance the morainic topography. Well developed terraces or benches occur along the Wabash River. The surfaces of these terraces range from nearly level to undulating. Many small terraces, benches or terrace remnants are found along the major tributaries, especially along Big Pine Creek.

Geology

Warren County was covered by the Wisconsin glacial drift. Well records show that the glacial drift ranges from zero along the Wabash River benches to more than 400 feet along the northwestern border of the county (Fig. 6). The great variations are due to the presence of



DERIVED FROM THE DANVILLE (NK 16-11) NATIONAL TOPOGRAPHIC 1° QUADRANGLES , SCALE 1/250,000

FIG. 5 TOPOGRAPHIC MAP OF WARREN COUNTY

(CONTOUR INTERVAL 50')

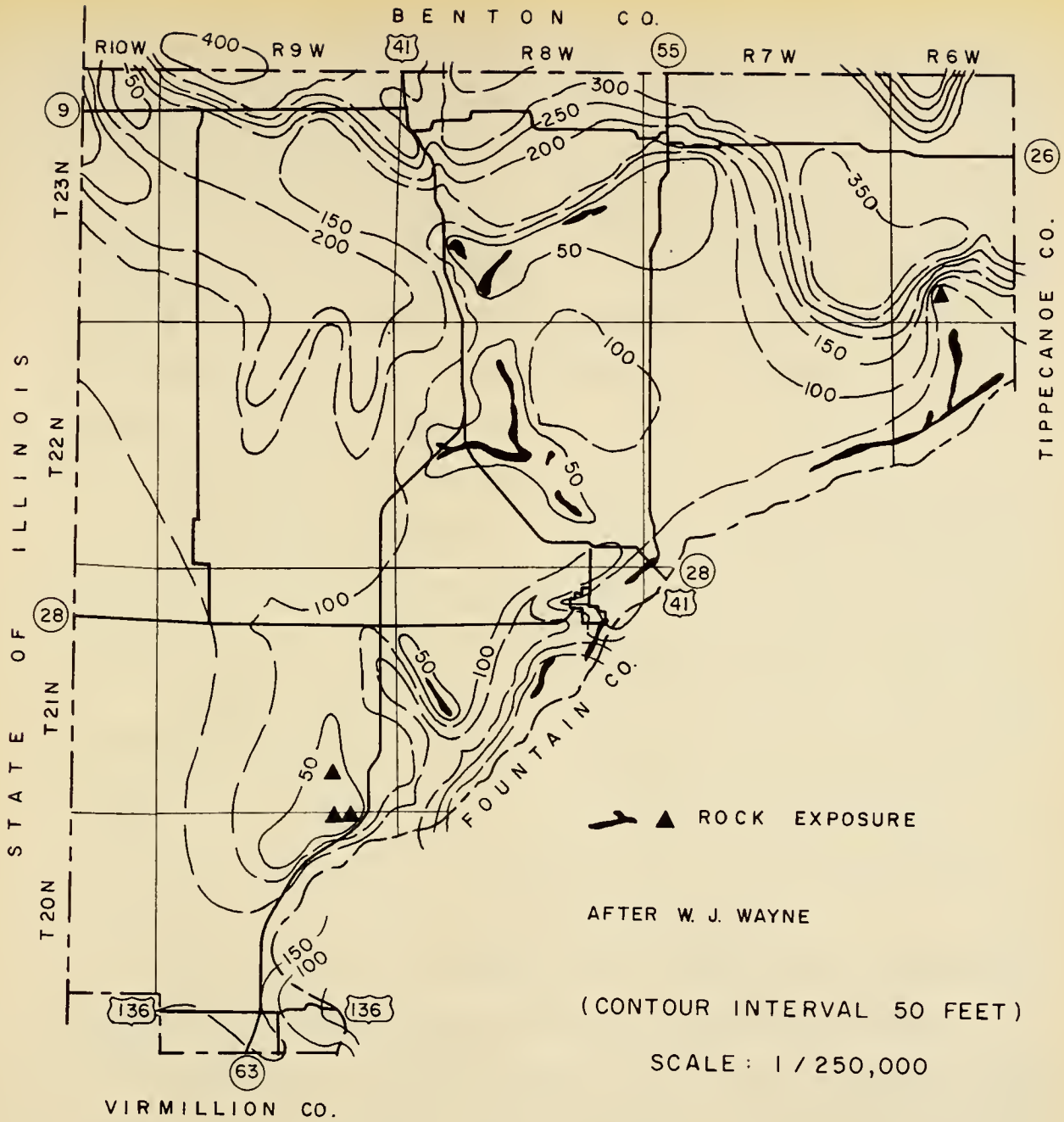


FIG. 6 THICKNESS OF GLACIAL DRIFT IN WARREN COUNTY, INDIANA

the buried Teays River and its tributaries (13). The buried Teays River follows a course parallel to the Benton-Warren County line before entering Illinois (14,15).

Boring records from the Big Pine Creek Reservoir study (16) show depth of the drift reaches 175 ft. in the southeast quarter of Section 35, T21N, R8W. It reveals that a preglacial valley exists in this area. The preglacial valley, now partly occupied by the Wabash River, is generally known as the Danville Valley (15,17).

Nearly all the glacial drift deposits of Warren County belong to the Bloomington morainic system, the largest moraine developed by the Illinois Lobe. The glacial material in the southwestern corner, however, were deposited by the Champaign morainic system. (Fig. 7).

The glacial deposits are covered by a thin layer of loess. The thickness of the loess varies and reached 40 inches or more on the upland near the Wabash Valley. In the river and stream valleys alluvial deposits occur. Occasionally terrace deposits are found, especially along the Wabash River and Big Pine Creek.

The bedrock strata beneath the glacial material in Warren County belongs to the Pennsylvanian, Mississippian and Devonian periods. New Albany Shale, the oldest fromation of the Devonian and Mississippian period, lies in the northeastern corner and the north-central part of the county (Fig. 8). Bedrock of most of the eastern half belongs essentially to the Borden Group. However, rock from the lower part of the Harrodsburg limestone and Rockford limestone of the Mississippian period are also included within this region. The western part is underlain by bedrock of the Carbondale group of the Pennsylvanian period. The youngest bedrock formation, the Raccoon Creek group of the Pennsylvanian period, occupies only a small area in the northwestern corner of

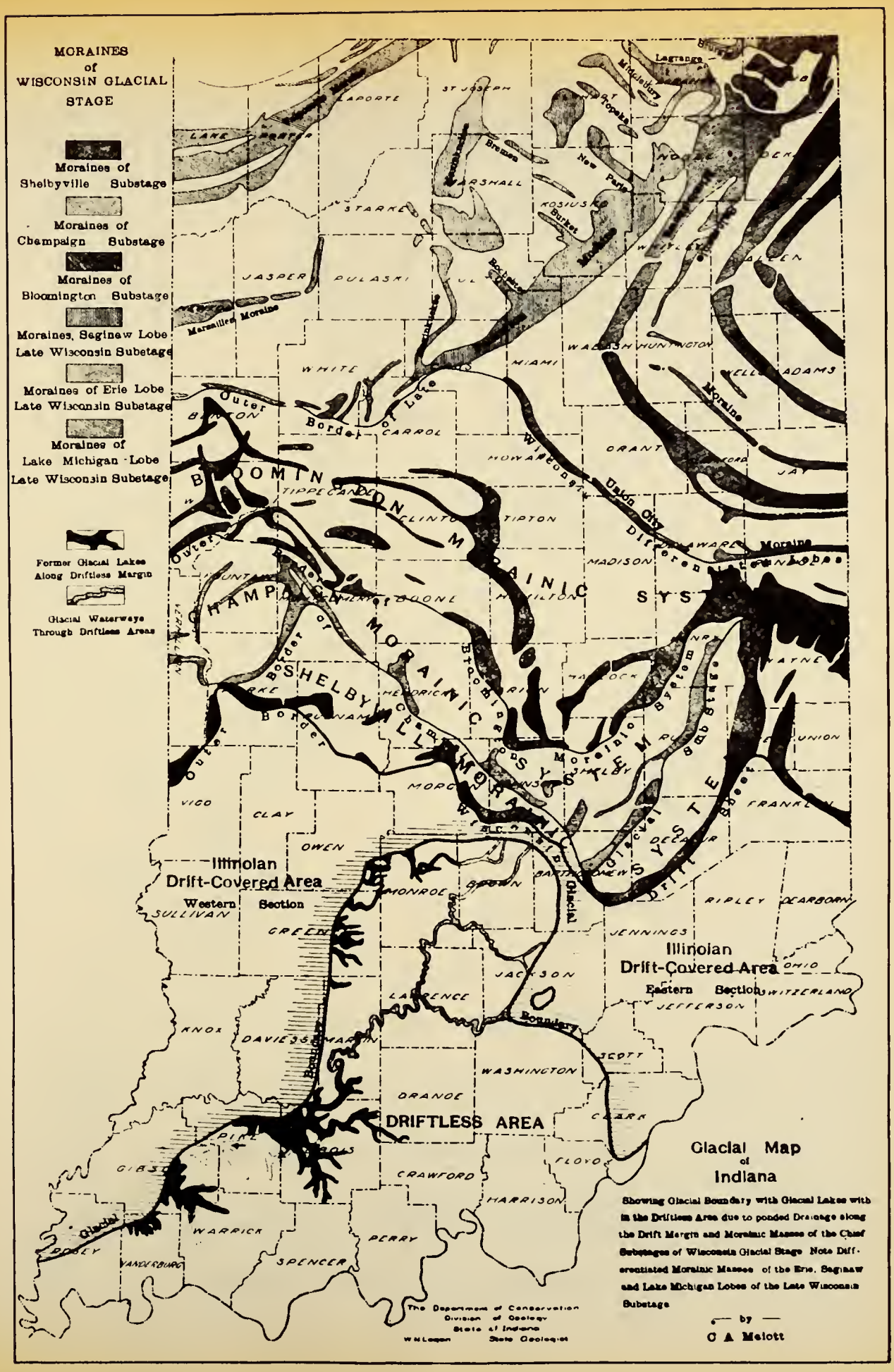
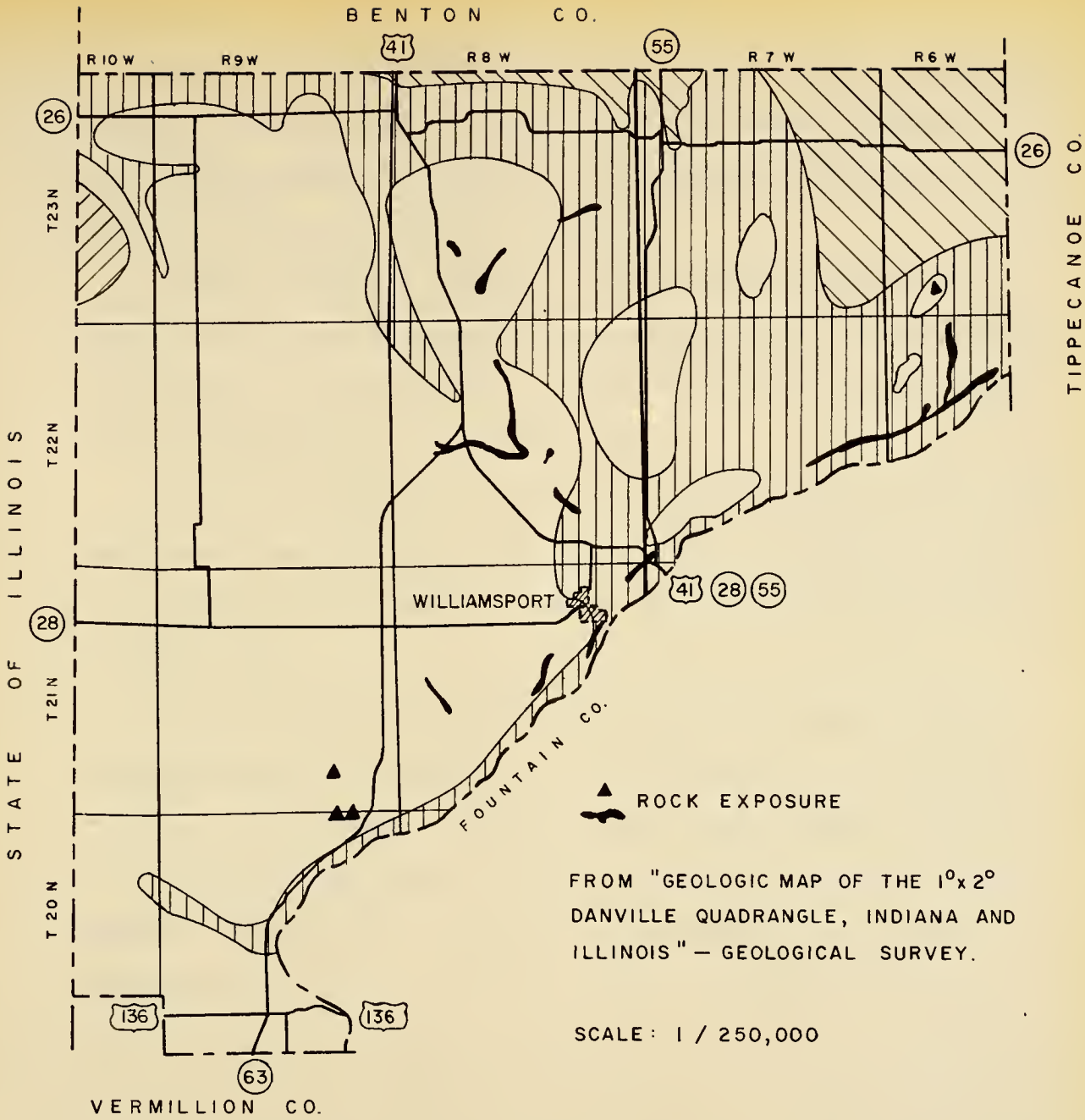

MORAINES of WISCONSIN GLACIAL STAGE
Moraines of Shelbyville Substage
Moraines of Champaign Substage
Moraines of Bloomington Substage
Moraines, Saginaw Lobe Late Wisconsin Substage
Moraines of Erie Lobe Late Wisconsin Substage
Moraines of Lake Michigan Lobe Late Wisconsin Substage
Former Glacial Lakes Along Driftless Margin
Glacial Waterways Through Driftless Areas
Illinoian Drift-Covered Area Western Section
Illinoian Drift-Covered Area Eastern Section
DRIFTLESS AREA
Glacial Map of Indiana
Showing Glacial Boundary with Glacial Lakes within the Driftless Area due to ponded Drainage along the Drift Margin and Morainic Masses of the Chief Substages of Wisconsin Glacial Stage Note Differentiated Morainic Masses of the Erie, Saginaw and Lake Michigan Lobes of the Late Wisconsin Substage
by
C A Malott
The Department of Conservation Division of Geology State of Indiana
W N Logan State Geologist

FIG. 7



RACCOON CREEK GROUP — PENNSYLVANIAN

NEW ALBANY SHALE - DEVONIAN AND MISSISSIPPIAN

CARBONDALE GROUP - PENNSYLVANIAN

LOWER PART OF HARRODSBURG LIMESTONE, BORDEN GROUP, AND ROCKFORD LIMESTONE — MISSISSIPPIAN

FIG. 8 GEOLOGIC MAP OF WARREN COUNTY.

the county.

Numerous rock exposures occur in Warren County (Fig. 6 and Fig. 8). They occur along the buff of the major river and streams within the county. They cannot all be mapped as residual soil areas on the attached map because of the scale limitation.

A massive Mansfield sandstone outcrops at Black Rock along the Wabash River at the southeastern corner of Warren County. Good exposures of the Mansfield sandstone can be observed at the high bridge over the Little Pine Creek (in section 5 T22N. R6W).

Sandstone, siltstone and shale outcrops are numerous along Big Pine Creek and the Wabash River. On the north edge of Williamsport, there is an outcrop of Carboniferous limestone (Keokuk limestone) a few feet in thickness (18).

Although the western part of Warren County is underlain by the Raccoon Creek group, coal exposures are not extensive. A seam of coal is exposed on the creek bed below the bridge located between Section 2 and 3, T20N, R9W, and along the creek where Coal Hollow Road is located (Section 10, T20N, R9W). Coal mining has been small in scale and underground (19).

LAND FORMS AND ENGINEERING SOIL AREAS

The engineering soils in Warren County are derived mainly from unconsolidated materials. The unconsolidated materials include glacial deposits, glacial-fluvial deposits, alluvial deposits, eolian deposits and cumulose deposits. A very limited area may be considered as residual soil. Due to scale limitation many narrow strips of rock or residual soil area along the Wabash River and along Big Pine Creek cannot be shown on the attached map. The reader should refer to Fig. 6 or Fig. 8 for their location.

Since the deposits of transported materials are far from homogenous, variation should be expected. General properties and profile of the soil for each area of different land form are presented in this report.

GLACIAL DEPOSITED MATERIALS

The major portion of Warren County is covered by glacial deposits of Wisconsin Age. The land froms include ridge or end moraine, ground moraine or till plain and kames. A thin loess mantle (from 18 to 36 inches in thickness) covers the glacial deposits. Because of only minor effects on the soil profile as a result of the loess cover, the region is considered a glacial deposit.

1. Ridge Moraine

The ridge morainic mass in Warren County is the result of the reentrant angle of the Bloomington morainic system. It covers about 60% of the county.

The texture of the ridge moraine varies from one place to the other. It is subdivided into three groups, namely: granular-textured ridge moraine, sandy-textured ridge moraine and medium-textured ridge moraine.

(A) Granular-Textured Ridge Moraine

Only a small area in Warren County is considered as granular-textured ridge moraine. The area is less than a quarter of a square mile and is located in Section 15 and Section 16, T23N, R9W, or about two miles northeast of Tab. The topography is higher than the surrounding sandy-textured moraine. The steep slope and the lack of surface drainage in this area reveals the granular nature of this deposit.

The surface soils of this deposit are chiefly loam, but silt loam or clay loam may appear in the high topographic positions. High organic content silty clay loam or clayey surface soils occur in the depressions. The B-horizon has a higher clay content than the surface soil; the texture ranges from sandy loam to clay. Stratified gravel and sand may be found in the C-horizon, otherwise, clay loam soil may be encountered.

(B) Sandy-Textured Ridge Moraine

About six or seven square miles of land in Warren County is classified as sandy-textured ridge moraine in the northwestern quarter of the county. The largest section of this sandy-textured moraine lies in the extreme northwestern corner of the county. Others are scattered, island-like, along the central portion of the northwestern quarter of Warren County.

The topography is generally undulating with occasionally rolling landscape. Infiltration basins are numerous in this region. Surface drainage is poorly developed or absent.

The soil of this region is developed under prairie vegetation. The surface soil varies from a sandy loam to loam in the high position

to an organic rich silty clay loam or clay in the depressions. The subsoil ranges from sandy clay loam to clay. The parent material is generally sandy loam, but clay loam and clay are found in many places.

(C) Medium-Textured Ridge Moraine

The majority of the morainic areas in Warren County belong to this category. Because of soil development under different vegetative conditions, the area is subdivided into timber regions and prairie regions. A belt north of the Wabash River and east of Big Pine Creek is covered by a thicker (about 40 inches) loess mantle and is classified as loess covered, medium-textured ridge moraine.

(a) Medium-Textured Ridge Moraine--Timber Region

About seven square miles of area in Warren County falls in this category. These deposits are mainly associated with Big Pine Creek and Mud Pine Creek. A large, isolated area is located about two miles south of Pine Village. These areas are easily identified on aerial photographs because of the presence of trees. Undulating to gently rolling topography dominates this region.

The A-horizon of this deposit ranges from silt loam to clay loam in the high position to a silty clay or clay in the low position. Silty clay and clay soils are found in the B-horizon. The parent material is predominately clay loam or clay in texture (A-4 to A-6). Occasionally sandy loam or gravelly-sand deposits may be found along small streams or gully bottoms as shown in boring sites 79, 80 and 84. These sandy and gravelly deposits are derived from fluvial action. These should be included in the water deposited materials. However, the mapping scale and symbols employed for the engineering soils map prevent a detailed mapping. The reader should keep in mind that granular material may be expected along the bottom of the streams or gullies.

(b) Medium-Textured Ridge Moraine--Prairie Region

About one third of the ridge moraine deposit in Warren County belongs to this classification. The most extensive deposit lies in the western half of the county. The morainic topography is weak over most of the region. Undulating landscape predominates the main portion of this moraine. Occasionally a gently rolling topography may exist.

The surface drainage systems are well developed in the reginn west of Big Pine Creek. However, dredged ditches are employed in many flat areas to improve the drainage.

The soil profile of this area consist of an organic topsoil underlain by medium-textured soils. The texture of the surface soil varies from a loam to a silty clay loam (A-6) at the high positions to a silty clay or clay (A-7-6) in the low topographic areas. The B-horizon contains a little more clayey material than the A-horizon. It ranges from a clay loam to clay in texture. The parent material is mainly a clay loam soil (A-4). However, clay or loamy soil (A-6) may be found in the C-horizon also.

(c) Loess Covered Medium-Textured Ridge Moraine--Timber Region

About 50 percent of the medium textured ridge moraine region is blanketed by a mantle of loess about 40 inches in depth. This deposit lies close to the Wabash River and east of Big Pine Creek. The loess cover has not modified the morainic topographic expression in this region. Hilly to rolling topography predominates, expecially in the vicinity of West Lebanon. The deep incision of the streams and gullies enhances the landscape of this region. The erosive nature of the loess mantle is indicated by the white fringe along the gullies on the aerial photographs. The soil development of the region has been developed under the influence of timber vegetation.

The surface soil contains a high percentage of silt (from 50% to 75%) and is generally classified as silty clay loam. The B-horizon is more clayey and varies from silty clay loam to clay (A-6 or A-7-6 soil). The parent material varies from a silt loam to a clay loam with an increasing amount of sands and gravels with depth. In the depressed areas the surface soil is more clayey and contains a slightly higher amount of organic matter.

(d) Loess Covered Medium-Textured Ridge Moraine--Prairie Region

About 27 square miles of land located in the northeastern quarter is recognized as loess covered, medium-textured ridge moraine developed under prairie condition. The topography of this moraine is very subdued. In many places a flat or nearly level landscape prevails. Stereo airphotos, however, show that the area has numerous shallow basins. The region may be considered as an ablation moraine. The thickness of the loess cover varies from about 18 to 36 inches on this morainic region.

Surface drainage is poorly developed. Ditches are dredged to facilitate the runoff. The basins are usually ponded after heavy rainfall.

The A-horizon of the soil profile in the prairie land is much darker in color and contains considerably larger amounts of organic matter than that of the timberland soil. The texture of the surface soil varies from a loam to silty clay loam in the high topographic positions. Higher clay content is usually shown in the B-horizon. Loam, clay loam and clay are the texture of the parent soil in this region. The soil profile in the depressions or basins are characterized by a deep organic silty clay to clay topsoil and a silty clay to clay subsoil. The parent material varies from loam to clay.

2. Ground Moraine

Only a small portion of Warren County is covered by ground moraine deposits. The largest deposit occurs in the northeastern quarter of the county and is the extension of the large ground moraine in Benton County. Other ground moraines are scattered along the county borders with Tippecanoe in the east, Vermillion County to the south, Benton County to the north, Vermillion County of Illinois to the west and near Big Pine Creek and Mud Pine Creek.

The topography of the ground moraine is nearly level except along the vicinity of drainage channels where dissection occurs producing undulating topography.

The ground moraine in Warren County can be subdivided into three groups, namely: sandy-textured ground moraine, medium-textured ground moraine and the loess covered medium-textured ground moraine.

(A) Sandy-Textured Ground Moraine

A number of areas (each about one square mile in size) located along the border line with Benton County and scattered in the northwestern quarter of Warren County are recognized as a sandy-textured ground moraine.

The topography of the sandy-textured ground moraine is slightly more undulating than the other ground morainic deposits. Besides the existance of a few shallow basins the surface drainage is absent in this area because of internal drainage characteristics. Ditches are used, however, in this area to lower the ground water level.

The soil developed in this region under the influence of prairie vegetation. The soil profile is essentially the same as the sandy-textured ridge moraine previously discussed. The difference is in the

A-horizon where thicker and slightly less sandy surface soils are found in the ground moraine deposits.

(B) Medium-Textured Ground Moraine

The majority of the ground moraine deposits fall in this category. The near level topography dominates except in the vicinity of drainage channels where undulating landscapes occur. Natural surface drainage is not very well developed because of the level topography. Ditches have been developed on these deposits. Because of the vegetational effect the soils of this deposit are subdivided into timber and prairie region.

(a) Medium-Textured Ground Moraine--Timber Region

The medium-textured ground moraine developed soils under the influence of timber. These deposits occur near Big Pine Creek and Mud Pine Creek. The areas are easily identified by the occurance of trees. The flat or nearly level topography is broken by the deeply dissected gullies and streams near the main drainage channels.

The top layer of the soil profile varies from silt loam to clay. The B-horizon is a plastic silty clay or clay. The parent material is classified generally as clay loam. However, clay or loam soil may be encountered.

(b) Medium-Textured Ground Moraine--Prairie Region

The medium-textured ground moraine deposits developed under the influence of prairie vegetation are confined to the northern half of Warren County. The largest area lies in the northeastern quarter of the county.

The topography of this region varies from gently undulating to nearly level. The ground moraine between Mud Pine Creek and Big Pine Creek is more undulating. Natural surface drainage is poorly developed.

Ditches are dredged in this region to combat the flat topography, especially in the area located in the northeastern quarter of the county.

The surface soil varies from a loam to an organic clay (A-4, A-6 to A-7-6), the B-horizon contains a little more clay and is classified as a clay loam or a clay. The parent material is either a loam, a clay laom or a clay (A-4 to A-6). A more sandy-textured soil may be found at or near the bottom of the gullies or streams in this region.

(C) Loess Covered, Medium-Textured Ground Moraine

Areas near the southwestern, southeastern and northeastern corners are classified as loess covered medium-textured ground moraine deposits. Due to the different type of vegetative cover, the deopsit is subdivided into timber and prairie region.

(a) Loess Covered, Medium-Textured Ground Moraine--Timber Region

The major portion of the loess covered medium-textured ground moraine developed under timber cover. An area approximately ten square miles lies along the Wabash River at the southwestern corner of the county. This area has a flat or nearly level topography broken only by the deeply incised gullies. The other area is situated east of Little Pine Creek at the northeastern corner of Warren County. The topography in this area is somewhat more undulating than the western one.

The surface drainage is poorly developed in the nearly level land or in the headwater areas. However, gullies and streams are deeply entrenched because of the great difference of base level (more than 100 feet) of erosion. The thickness of the loess varies from place to place. It is much thicker near the Wabash River and diminsihes rapidly away from the valley. Boring profiles from site No. 1 to No. 13 illustrate this phenomenon.

The soil profile developed in this region may be entirely from the loess deposit in the area where the loess deposit is deep. Silty clay (A-6) soil is common in the upper horizon. Silty loam (A-6) or clay loam (A-4) soils are the parent material. The soil profiles in the valley wall in this region are quite different. The loess deposit may be entirely removed and substituted with water deposited material eroded from the upland.

(b) Loess Covered, Medium-Textured Ground Moraine--Prairie Region

At the northeastern corner and the extreme southwestern corner occur small deposits recognized as loess covered, medium-textured ground moraine developed under prairie vegetation. Very gently undulating to nearly level topography is found in these areas.

Surface drainage is poorly developed or absent. Many shallow depressions are scattered in the area situated at the southwestern corner of the county.

The loess cover in this area varies from 18 to 36 inches. The soil profile is characterized by an organic loam to silty clay loam top soil in the high position to an organic clay in the low depression, a silty clay to clay subsoil and generally a clay loam parent material.

3. Moraine on Bedrock

Several areas in Warren County occur where bedrock is exposed near the ground surface and are mapped as moraine on bedrock. The largest area is located along the Wabash River bench just north of Independence. The other one (less than one square mile) lies east of the Little Pine Creek bordering the Wabash River flood plain. The third, about one and one half square miles, is situated south of Williamsport.

The drift is less than five feet in depth over sandstone and shale bedrock benches (20). At Black Rock, located at the extreme southeast corner of Warren County, the massive sandstone is exposed at the ground

surface. Rock exposures occur frequently on the slopes or surface breaks with the adjacent terraces.

Surface drainage is influenced greatly by the underlying bedrock. A compound gully cross section and gradient may be observed in this area as the water cuts through the unconsolidated drift and into the underlying bedrock. Areas located southwest of Williamsport and east of Little Pine Creek have very little surface drainage.

The soil profile of this region is derived mainly from the drift material, however, in the thin drift areas the soil may be partially derived from the weathering of the bedrock. In the outcropping area a thin layer of sandy loam may be present on the surface, or the solid bedrock may be exposed. This soil profile should be applied equally well to the narrow zones along the major drainage channels where bedrock outcrops occur.

4. Kames and Eskers

There are a number of kames in Warren County. One group occurs north of Judyville, another group is located northeast of Kates Pond and North of Independence. An isolated one lies about two and one half miles northeast of Tab.

The group located north of Judyville may be considered as an esker chain because three hills are elongated and can be considered in a linear formation. Burrow pits or gravel pits are developed in three of these deposits.

The soils developed on eskers and kames vary considerably. Due to the thin loess mantle and the degree of erosion, the A-horizon varies greatly in both texture and thickness. Sandy loam, loam, clay loam, silt loam and silty clay loam may be found. In areas of severe erosion the surface soil may be entirely removed and the subsoil is exposed. The B-horizon ranges from clay loam to clay with various amounts of sand and gravel.

The amount of sand and gravel increases with depth. Clean stratified sands and gravels are found in the parent material zone. This stratified, coarse material disappears at the base of the esker or kame and merges with the medium textured glacial drift of the surrounding areas.

5. Boulder Belts

Many boulder patches are scattered in Warren County. Most of them are located in the western half of the county. Because they are small in extent no attempt is made to include all of them on the attached soils map. However, three boulder belts are recognized and mapped. The largest one lies just west of Big Pine Creek and Mud Pine Creek and extends from the Wabash River near Williamsport into Benton County to the north. The other one occurs along the Wabash River from a point near the Tippecanoe County border and extends through Independence and turns northerly after crossing Kickapoo Creek. The third one is situated along the northeastern corner of the county. This one is part of the Fowler-Lafayette boulder belt.

Owing to the intensive farming and clearing activities in the county a great number of boulders that were strewn over the surface have been removed. Therefore, the exact position of the belt cannot be determined. The outline of the belt on the attached engineering soils map is based on the literature (13) and limited field checks. Most of the boulders are about a foot or two in diameter. A high concentration of boulders is found in the vicinity of Independence.

FLUVIAL DEPOSITED MATERIALS

About one sixth of Warren County is covered by fluvial deposited materials. Three different land forms created by the action of water, namely outwash plain, terrace, and flood plain are discussed.

1. Outwash Plain

Two areas along Big Pine Creek and a larger area (about 30 sqare miles) located on the western part of Warren County are considered as outwash plain deposits. Due to the differenc type of vegetative cover, the deposits are subdivided into timber and prairie regions.

(a) Outwash Plain--Timber Region

The areas along Big Pine Creek are located on the upland where the flood plain suddenly is reduced in size and is restricted by the bedrock. The outwash plains are somewhat lower topographically than the adjacent morainic uplands. They have a comparatively flat surface. Surface drainage is generally not well developed. However, a few deep gullies exist. The presence of deep gullies is the result of a change in base level of erosion. Some infiltration basins occur on this deposit (Fig. 9).

The boring logs (see appendix B and Fig. 10) of the proposed Big Pine Creek Reservoir confirms the interpretation that an outwash deposit exists in this area. The cross-section shown in Fig. 11 reveals that the overburden on the gravel and sand outwash deposit is about five to ten feet thick. The Edwardsville Formation of siltstone and fine grain sandstone lies from ten to fifteen feet below the surface (Fig. 11). According to boring logs (DC-1, DC-4, DC-5, D 201 and A 229-A242 in appendix B) the overburden varies from silty clay to sandy clay (classified as CL) in the top stratum or a clayey sand (classified as ML to SC) in the substratum. The amount of sands and gravels increases with depth and as a whole the major portion of this deposit is sand.

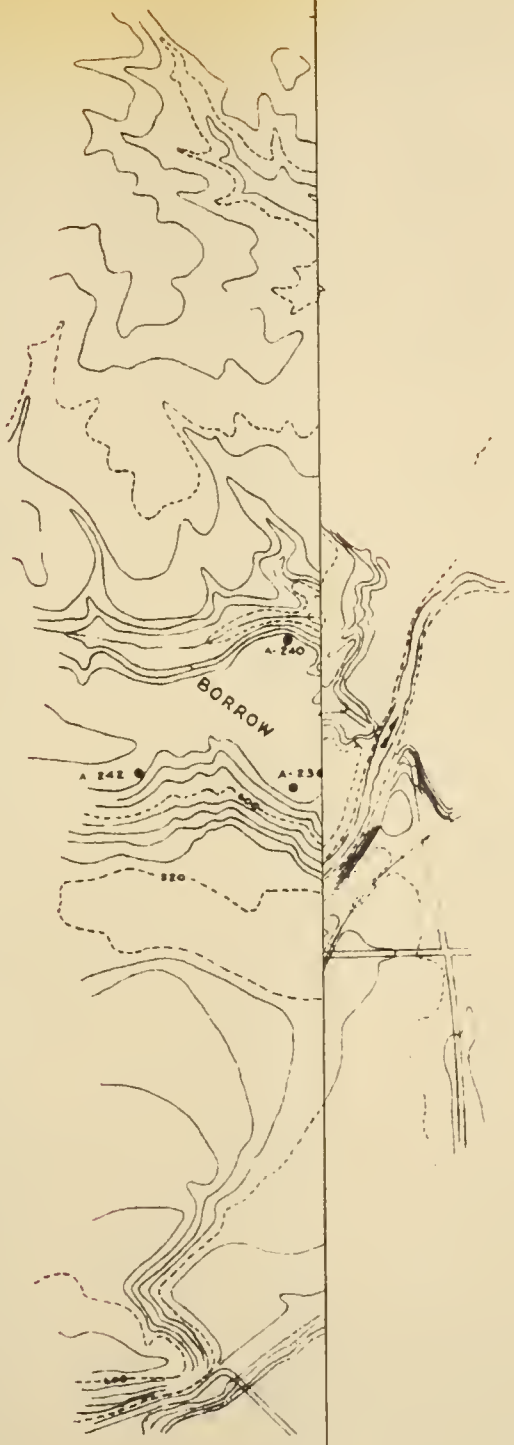
(b) Outwash Plain-- Prairie Region

The large outwash plain im the western part of the county is somewhat

FIG. 9 LAND FORMS AND BORING SITES IN THE VICINITY OF THE PROPOSED BIG PINE CREEK RESERVOIR

CORPS OF ENGINEERS,

U. S. ARMY



REVISION	DATE	DESCRIPTION	BY

U. S. ARMY ENGINEER DISTRICT, LOUISVILLE
CORPS OF ENGINEERS
LOUISVILLE KENTUCKY

DESIGNED BY:
DRAWN BY: J.P.M.
TRACED BY: —
CHECKED BY: W. D. L.
CHIEF, CIVIL ENGINEERING DIV.
CHIEF, ENGINEERING DIVISION

WABASH RIVER BASIN
BIG PINE RESERVOIR
WARREN COUNTY IND

DAM SITE

APPROVED:
COL. CORPS OF ENGINEERS, DISTRICT ENGINEER

DATE: JUNE 1962

APPROVED:
DATE

SCALE:

DRAWING NUMBER

PLATE E-14

FIG. 10. LOCATION OF SOIL BORINGS AT DAM SITE OF BIG PINE CREEK RESERVOIR

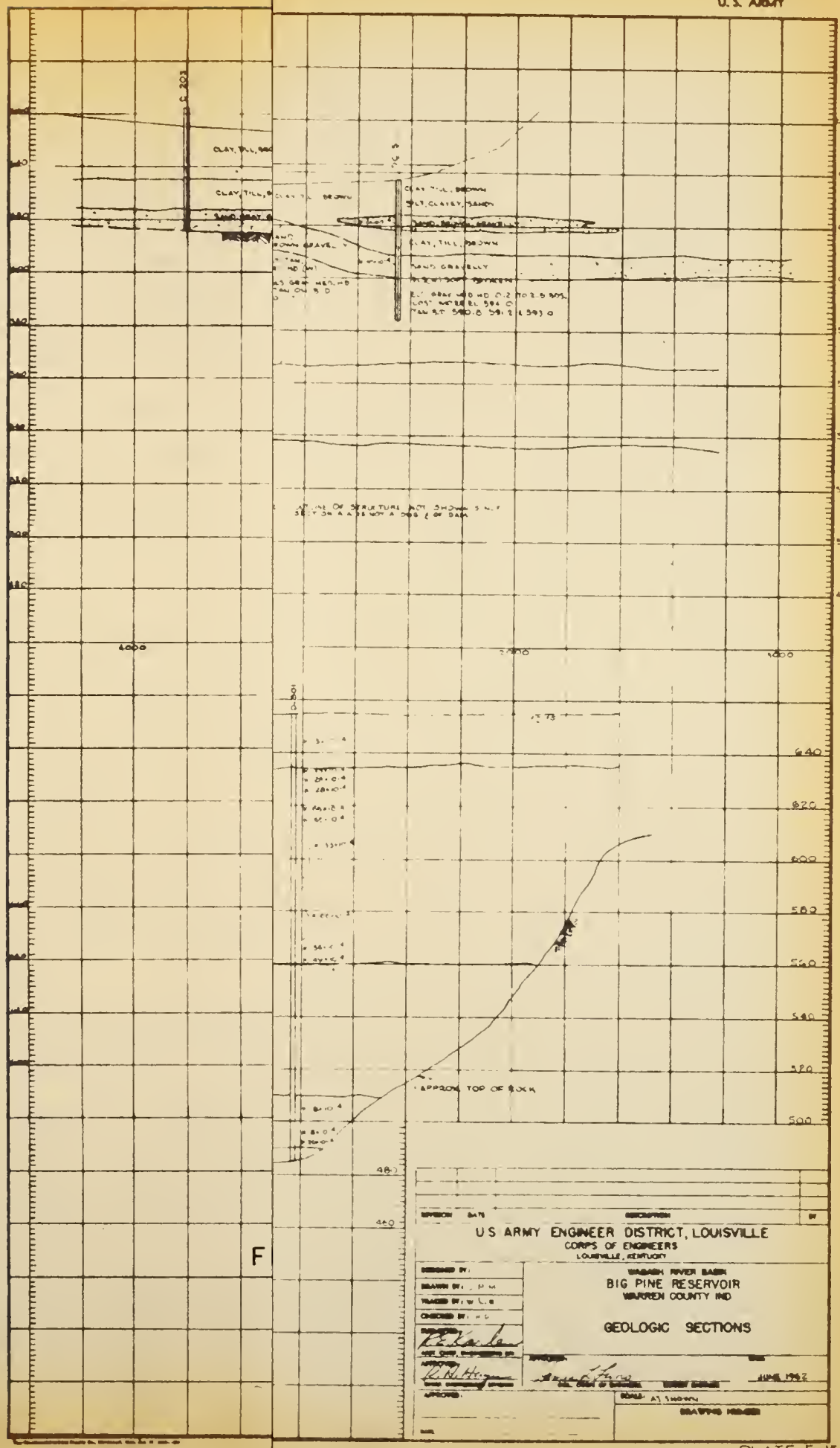
U. S. ARMY ENGINEER DISTRICT, LOUISVILLE
CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY

WABASH RIVER BASIN
BIG PINE RESERVOIR
WARREN COUNTY, IND

DAM SITE

CORPS OF ENGINEERS

U.S. ARMY



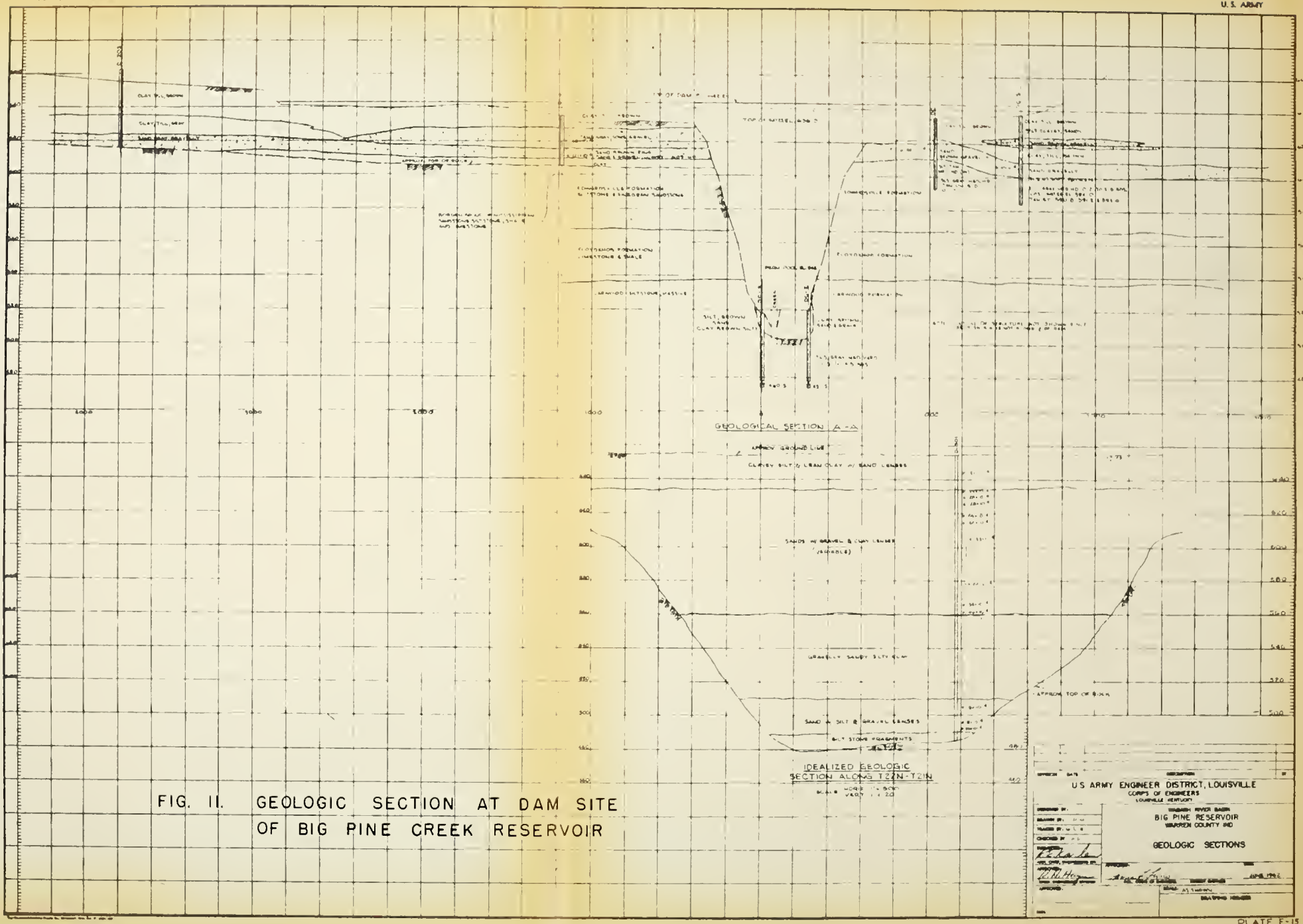


FIG. 11. GEOLOGIC SECTION AT DAM SITE OF BIG PINE CREEK RESERVOIR

different in appearance than those located in the timber region. With a few very shallow basins and occasional low knobs the surface of this area is extremely flat and featureless. The outwash plain is lower than the surrounding ridge and ground moraine and slopes very gently in the southwest direction. Natural surface drainage is absent; however, ditches are dredged extensively in this area to improve the surface drainage.

This outwash plain is situated along a former glacial sluiceway. A coarser deposit is expected at depth. Field checks and literature (20) confirm this condition. Scovall reported that "in the northeast quarter of section 17, in the northwest quarter of section 16 and in section 8 and 9, T22N, T9W, there is an extensive deposit of water gravel" (20). About three feet of soil covers 10 to 14 feet of sand and gravel. An old gravel pit (now a pond) is located about 1.5 miles east of Stewart. Exposures show the deposit is rather fine (i.e., more sands than gravels).

The surface soil in general is an organic silty clay soil. The amount of clay increases in the B-horizon and a hard pan is present in most areas. Clean sands and gravels are found in the lower stratum.

2. Terraces

Many terraces are recognized and mapped along the Wabash River, Big Pine Creek, Mud Pine Creek, Rock Creek and Redwood Creek. These terrace deposits are subdivided into two types according to the thickness of the fluvial deposit, namely: gravelly-textured terraces and thin terrace deposits on rock benches.

(A) Gravelly-Textured Terraces

The gravelly-textured terraces are mainly associated with the Wabash River valley. One is located in the vicinity of Independence. Another lies southwest of Williamsport. A third deposit occurs at the southern most edge of Warren County. Narrow strips of terrace deposits occur along the upper end of Big Pine Creek. The one that extends into Benton County is possibly a kame terrace rather than an ordinary stream terrace. The average height of the Wabash River terrace deposits is about 60 feet above the river. The surface topography of the terraces varies from rolling to level with erosional valleys ranging from five to twenty feet deep (21). Numerous infiltration basins occur on the terraces. Creeks and large gullies which carry great volumes of water from the upland have cut across the gravelly terrace deposits in many places.

Leighty's report (21) indicates that 15 feet of granular terrace deposit overlays ten feet of till which is perched on sandstone and shale bedrock just east of Independence.

The surface soil varies greatly from place to place. It ranges from a sandy loam to a silty clay loam. The B-horizon shows generally an increase of clay and plasticity with respect to the layer above. An increase in the amount of sand and gravel is found within the C-horizon. The parent materials are encountered at a depth of 24 to 44 inches and consist of stratified sands and gravels.

Several gravel pits have been developed on the terraces. The largest one is located near the southwestern corner of the county as shown on the attached soils map.

(B) Thin-Terrace Deposits on Rock Benches

Many narrow strips along the Wabash River, Big Pine Creek, Mud Pine Creek, Mud Run Creek and Rock Creek are recognized as thin terrace deposits on rock benches. The surface features of this region vary from a remarkably flat area to a moderately dissected land. Both of the areas that lie east of Independence and southwest of Williamsport are more dissected by shallow surface gullies. However, these areas clearly possess a bench-like land form in the Wabash River valley. There are a number of thin terrace deposits over bedrock that occur as islands in the valley of the Big Pine Creek. The surface of those islands are sloping toward the down-stream direction. Current scars and infiltration basins may be present in some areas where the terrace deposits are thick. In the very thin terrace deposit area the surface is extremely flat as shown in the areas west of Independence and east of Williamsport.

The surface soil texture and depth of development vary greatly. In places, the unconsolidated deposits are almost entirely removed from the rock benches. The soil profile is characterized by a sandy loam to a clayey topsoil underlain by a sandy clay loam to clayey subsoil. Rock pebbles or fragments occur before the solid bedrock is reached. The bedrock varies from siltstone to sandstone and shale. Some of the siltstones are hard and thick while others are thinly bedded.

3. Flood Plain

All drainage channels in Warren County possess recent flood plains. However, the extent of mapping of these plains was determined by the scale of the engineering soils map.

The largest flood plain is associated with the Wabash River. Big Pine Creek, Mud Pine Creek and Kickapoo Creek also exhibit wide flood plains. Most of the flood plains have flat to nearly level surfaces. Numerous natural levees and current scars occur along the major drainage channels.

The texture of the flood plain deposits varies greatly both horizontally and vertically from one place to the other, depending mainly on the nature of the drainage basin. Coarse-textured deposits at depth are generally located along the Wabash River and Big Pine Creek. Sandy or silty deposits are found along the natural levees.

The surface soil varies from a sandy loam to a clay loam in the high areas to an organic silt or clay in the low depressions. The underlying layers are also extremely variable. Stratified sands and gravels, sometimes silt and clay, are found in the substratum. Sandstone and shale bedrock also may be encountered at shallow depth.

In the swales and depressions of the slack water area where water may be ponded, such as the strip at the south end of the Wabash River flood plain, a highly organic silt loam to clayey topsoil may be found. The underlying material is usually silty clay or stratified silt, sand and clay. The area is mapped as a highly organic topsoil depression.

EOLIAN DEPOSITED MATERIAL

There are extensive eolian (wind) deposits in Warren County. The eolian deposits are subdivided into two groups: loess mantle deposits and sand dune deposits.

Nearly the entire area of Warren County is covered by a thin mantle of loess. As mentioned previously, the mantle varies in depth

from 18 to over 40 inches. Since the mantle is realtively uniform and comparatively thin, only the top part of the soil profile is subject to loess influence. Therefore, the discussion of this loess mantle is not treated seperately but included with the glacial land forms previously discussed.

Sand Dune

The sand dune deposits in Warren County are very limited. In the sandy ground moraine and the broad Wabash River terrace some sand ridges or knobs may be present, but they are too small to be mapped. The only sand dune with a definite form occurs on the outwash plain located about two miles north of Tab. This lone sand dune or sand ridge is about three quarters of a mile in length and orientated in a east-west direction. The sand dune is very narrow and low in relief.

The soil profile consists of a very friable sand or sandy loam topsoil underlain by a loose sandy B-horizon. The substratum ranges from sandy clay to clay loam before reaching the material of the outwash deposit.

RESIDUAL SOIL

Residual soils (Or colluvial soils) developed from interbedded sandstone, siltstone and shale are found only to a limited extent in Warren County. As mentioned previously, many bedrock outcrops occur along the major valleys in Warren County. However, very little residual soils are found on those areas because of steep slopes and severe erosion. Many of the glacial deposits are also washed onto the bedrock surfaces and prevent the development of residual soils. Two small areas located near the confluence of Big Pine Creek and Mud Pine Creek are mapped as residual soil areas. The areas are higher than the surrounding

flood plains. The exposed rocks usually have a flat surface so that residual soil can be developed. The Black Rock area at the southeastern corner of Warren County also may be considered as residual soil area, but very little soil occurs on top of the sandstone bedrock.

The residual soils developed in these areas are from massive siltstone or very fine grained sandstone. The A-horizon varies from a very fine sandy loam to a silty clay loam. The amount of stone fragments increases with depth and also with the amount of clay content. Bedrock may be encountered at a very shallow depth.

CUMULOSE MATERIALS

Accumulation of cumulose or organic materials occur frequently on the various land forms previously described. The most frequently occuring cumulose deposits occupy basins in the ridge moraine and ground moraine regions. On slightly depressed basins, highly organic topsoils may occur that would influence engineering decisions. These cumulose deposits are indicated on the map and discussed as follows:

1. Peat and Muck Basins

Cumulose deposits of peat and muck are mainly confined to the eastern third of Warren County. The largest one is located in the northeastern corner about tree miles north of Green Hill. Other large basins occur along Kickapoo Creek. Kates Pond, situated about two miles northwest of Independence, is covered with water.

Most of the peats are derived from mosses, sedges and wood. In some basins a soft layer of marl may be found under the peat and muck deposits. The marl is an earthy material composed principally of an amorphous form of calcium carbonate. Since it is also undesirable

from the engineering standpoint, no separation is made from the peat and muck in the soil profile illustrated. The depth of these cumulose deposits will vary greatly from one location to another. Field investigation of each individual deposit is required. A commercial peat excavation is operated on the largest deposit as mentioned previously.

2. Highly Organic Topsoil Depressions

Depressed areas, where internal drainage is somewhat retarded, usually give rise to the accumulation of organic topsoil. A number of such deposits occur in Warren County. Most of these deposits are concentrated in the northern half of the county. The largest one is located about four miles north of Independence.

The soil profile consists of a highly organic silty clay or clay topsoil, a plastic silty clay or clayey subsoil and a loam, clay loam parent material.

Two narrow strips along the flood plain of the Wabash River are slack water areas. The texture of upper horizons are the same as mentioned above. However, alluvial sand and gravel deposits may be found in the substratum.

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APPENDIX A

Soil Boring Data Along SR 63 and US 41

The soil test data tabulated below was obtained from consultants' reports prepared for the Indiana State Highway Commission. The location of the site is shown on the attached engineering soils map. Considerable additional data is contained in the consultants' reports.

SITE	STATION	OFFSET (ft.)	DEPTH (ft.)	TEXTURE	AASHO CLASS	PERCENTAGE					
						PASS. #10	SAND	SILT	CLAY	LL	PI
1	643+00	42 Rt.	10.5-12.0	Clay loam	A-4 (6)	96	37	41	22	21	8
2	671+50	105 Rt.	1.0-2.5	Clay loam	A-6 (8)	99	30	48	22	30	13
			6.0-7.5	Silt loam	A-4 (5)	99	38	50	12	25	8
3	687+00	42 Rt.	0.5-2.0	Sandy loam	A-2-6 (1)	77	71	18	11	35	16
4	692+50	42 Rt.	2.0-4.0	Silt loam	A-4 (6)	97	34	54	12	24	8
			4.0-6.0	Laom	A-4 (3)	92	48	34	18	27	10
5	698+00	42 Rt.	5.0-6.0	Silty clay	A-7-6 (16)	100	5	51	44	50	25
6	18+10	100 Rt.	11.0-12.5	Clay loam	A-6 (5)	95	41	30	29	23	11
7	40+50	42 Lt.	1.0-2.0	Clay	A-6 (10)	100	12	45	43	39	15
			6.0-7.0	Silty clay loam	A-4 (8)	95	6	66	28	29	9
			10.0-11.0	Sandy loam	A-4 (3)	96	51	34	15	NP	NP
8	77+50	42 Lt.	1.0-2.0	Silty clay	A-7-6 (14)	100	9	51	40	43	23
			7.0-8.0	Clay loam	A-6 (7)	97	34	45	21	29	12
9	82+00	42 Rt.	1.0-2.0	Silty clay loam	A-4 (8)	98	12	63	25	26	7
			5.0-6.0	Silty clay loam	A-4 (8)	100	1	72	27	28	10
10	100+00	42 Rt.	8.5-10.0	Sand	A-3 (0)	98	92	6	2	NP	NP
			16.0-17.5	Sandy gravel	A-1-a (0)	33	91	7	2	NP	NP

APPENDIX CONT'D.

SITE	STATION	OFFSET (ft.)	DEPTH (ft.)	TEXTURE	AASHO CLASS.	PERCENTAGE				LL	PI
						PASS. #10	SAND	SILT	CLAY		
11	112+00	75 Rt.	5.0-7.0	Silt loam	A-4 (8)	99	5	78	17	25	5
			19.0-20.0	Sand	A-2-4 (0)	90	85	7	8	NP	NP
			45.0-47.0	Clay loam	A-4 (4)	88	43	30	27	24	10
12	134+00	42 Rt.	1.0-2.0	Silty clay	A-6 (8)	100	3	56	41	38	11
			11.0-12.0	Sandy loam	A-1-b (0)	79	75	14	11	15	3
13	183+00	42 Lt.	7.0-8.0	Silt loam	A-4 (8)	95	22	64	14	21	2
14	188+00	42 Rt.	19.0-20.0	Sandy loam	A-4 (2)	95	57	27	16	18	NP
15	194+00	42 Lt.	1.0-2.0	Silty clay	A-6 (12)	100	1	69	30	39	20
			15.0-16.0	Sand	A-1-b (0)	69	80	12	8	NP	NP
16	240+00	℄	1.0-2.0	Silty clay loam	A-6 (10)	100	3	68	29	34	15
			7.0-8.0	Clay loam	A-4 (5)	96	41	32	27	22	9
17	251+65	55 Rt.	8.5-10.0	Clay loam	A-4 (8)	95	24	47	29	20	7
18	264+00	30 Lt.	5.5-6.0	Silty clay	A-7-6 (17)	92	13	52	35	47	28
19	270+10	42 Rt.	3.5-4.0	Silty clay	A-7-6 (14)	100	5	55	40	47	22
20	278+00	42 Lt.	6.0-7.0	Silty clay loam	A-4 (8)	93	24	56	20	23	6
21	300+12	42 Lt.	1.5-2.0	Silty clay	A-7-6 (14)	99	6	54	40	46	21
22	309+40	42 Lt.	7.5-8.0	Clay loam	A-6 (5)	98	45	33	22	25	13
23	339+00	42 Rt.	1.0-2.0	Sandy loam	A-2-4 (0)	95	75	17	8	NP	NP

APPENDIX CONT'D.

SITE	STATION	OFFSET (ft.)	DEPTH (ft.)	TEXTURE	AASHO CLASS.	PERCENTAGE				LL	PI
						PASS. #10	SAND	SILT	CLAY		
24	340+00	42 Lt.	8.5-10.0	Clay loam	A-6 (7)	95	36	35	29	24	12
25	361+00	42 Rt.	1.0-3.0	Silty clay loam	A-4 (8)	99	6	68	26	31	10
26	380+25	℄	3.0-4.0	Silty clay	A-7-6 (15)	100	2	53	45	49	22
27	407+50	42 Rt.	8.0-14.0	Clay	A-6 (8)	92	19	46	35	27	11
			21.0-22.0	Sandy loam	A-2-4 (0)	76	69	22	9	14	2
			26.0-27.0	Sand	A-2-4 (0)	92	85	1	14	NP	NP
28	472+50	42 Rt.	0.0-2.0	Clay	A-6 (9)	100	11	50	39	31	12
29	477+25	5 Rt.	0.0-2.0	Clay	A-7-6 (13)	100	14	36	50	41	21
30	480+00	42 Rt.	2.0-4.0	Clay	A-6 (13)	98	17	40	43	39	22
31	485+00	42 Rt.	16.0-17.0	Clay loam	A-4 (5)	94	38	40	22	16	5
32	514+25	42 Lt.	16.0-17.5	Clay loam	A-4 (5)	89	38	38	24	20	9
33	534+37	45 Lt.	3.5-5.0	Clay	A-7-6 (20)	100	6	45	49	58	32
34	556+25	42 Rt.	4.0-5.0	Clay	A-7-6 (12)	94	24	34	42	41	19
35	573+60	42 Rt.	9.0-10.0	Clay loam	A-4 (8)	95	24	50	26	22	9
36	580+00	42 Rt.	6.6-8.6	Clay	A-6 (9)	100	24	42	34	31	12
37	585+35	42 Rt.	2.0-3.0	Silty clay	A-7-6 (17)	100	2	64	34	54	26
38	594+00	42 Rt.	4.0-6.0	Loam	A-4 (5)	93	39	43	18	28	10
39	600+60	42 Lt.	2.0-4.0	Clay	A-7-6 (18)	99	17	43	40	52	31

APPENDIX CONT'D.

SITE	STATION	OFFSET (ft.)	DEPTH (ft.)	TEXTURE	AASHO CLASS.	PERCENTAGE				LL	PI
						PASS #10	SAND	SILT	CLAY		
40	633+00	42 Lt.	0.8-2.5	Clay	A-6 (8)	100	28	39	33	35	12
			5.0-6.5	Sandy loam	A-2-4 (0)	99	70	22	8	NP	NP
41	643+00	42 Lt.	3.6-4.6	Silty clay	A-7-6 (17)	100	12	51	37	48	28
42	678+00	42 Lt.	4.0-5.0	Clay loam	A-7-6 (7)	93	50	21	29	41	22
43	715+00	42 Lt.	2.6-4.0	Clay loam	A-6 (7)	96	46	32	22	34	17
44	720+00	42 Rt.	2.0-4.0	Silty clay	A-7-6 (19)	99	12	52	36	53	31
45	724+00	42 Lt.	3.5-5.5	Clay loam	A-6 (10)	95	28	47	25	33	17
46	749+50	42 Lt.	13.0-14.0	Clay loam	A-7-6 (18)	95	26	45	29	48	34
47	54+50	℄	9.0-10.0	Sandy loam	A-2-4 (0)	98	77	5	18	20	6
48	793+25	42 Rt.	2.0-3.0	Clay	A-7-6 (8)	94	40	27	33	45	16
			4.0-5.0	Clay loam	A-6 (9)	95	37	33	30	36	19
49	813+20	42 Rt.	2.2-4.2	Clay	A-7-6 (12)	95	38	26	36	50	23
50	843+00	42 Rt.	10.0-12.0	Sandy loam	A-4 (0)	99	64	17	19	19	7
51	854+00	42 Lt.	3.0-4.0	Clay	A-6 (10)	100	19	38	43	31	16
			9.0-10.0	Clay	A-6 (8)	93	39	30	31	33	17

APPENDIX CONT'D.

SITE	STATION	OFFSET (ft.)	DEPTH (ft.)	TEXTURE	AASHO CLASS.	PERCENTAGE				LL	PI
						GRAVEL	SAND	SILT	CLAY		
52	309+50	42 Rt.	14.0-15.0	Clay loam	A-4 (7)	5	26	43	26	22	8
53	315+00	42 Rt.	1.0-2.0	Silty clay	A-7-6 (19)	4	2	54	40	57	33
			8.5-10.0	Clay loam	A-4 (6)	9	28	40	23	23	9
54	360+00	20 Lt.	4.0-6.0	Silty clay	A-6 (12)	5	10	52	33	40	20
55	371+50	75 Rt.	3.0-5.0	Silty clay loam	A-6 (12)	0	10	60	30	39	19
56	382+75	℄	8.0-9.5	Clay loam	A-4 (5)	10	30	40	20	19	7
57	397+00	42 Rt.	5.0-6.0	Clay loam	A-4 (6)	6	27	41	26	24	10
58	402+00	42 Rt.	5.0-6.5	Loam	A-4 (4)	5	38	45	12	16	2
			8.5-10.0	Loam	A-4 (4)	3	42	48	7	NP	NP
59	438+00	42 Lt.	0.5-2.0	Silty clay loam	A-6 (8)	0	12	64	24	34	11
			6.0-8.0	Silty clay loam	A-4 (8)	0	20	57	23	22	5
60	449+00	42 Lt.	6.0-7.5	Clay loam	A-6 (8)	10	28	42	20	29	13
61	458+85	42 Lt.	9.0-10.0	Clay	A-6 (8)	5	22	41	32	25	11
62	480+00	42 Lt.	0.0-2.0	Silty clay	A-6 (9)	0	10	60	30	36	13
63	483+50	42 Lt.	0.0-0.5	Silty clay loam	A-4 (8)	0	12	66	22	31	9
			13.0-14.0	Clay	A-6 (8)	7	18	45	30	26	11
64	485+50	42 Rt.	2.0-4.0	Clay	A-7-6 (20)	0	1	45	54	60	32

APPENDIX CONT'D.

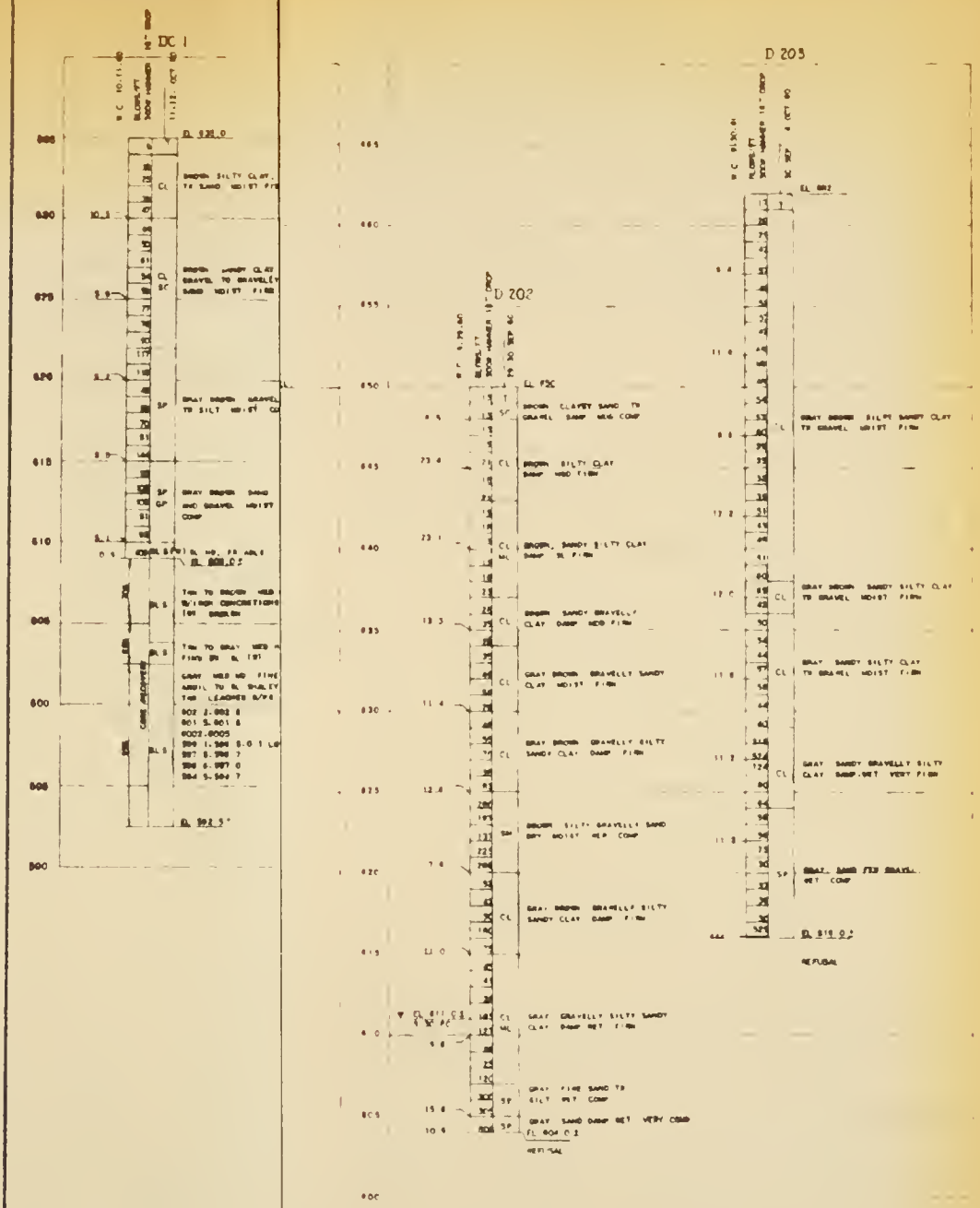
SITE	STATION	OFFSET (ft.)	DEPTH (ft.)	TEXTURE	AASHO CLASS.	PERCENTAGE				LL	PI
						GRAVEL	SAND	SILT	CLAY		
65	507+00	42 Lt.	7.5-8.0	Clay	A-7-6 (19)	17	1	44	38	54	28
			10.0-11.5	Silty clay loam	A-6 (8)	5	4	66	25	37	11
66	513+50	42 Lt.	1.5-9.5	Clay	A-6 (9)	13	24	28	35	37	18
67	534+50	42 Rt.	2.5-4.0	Sandy loam	A-2-4 (0)	2	63	24	11	NP	NP
68	539+50	42 Lt.	4.0-5.0	Clay lacm	A-4 (6)	4	30	36	30	27	10
69	545+00	42 Rt.	2.0-4.0	Silty clay	A-7-6 (13)	4	7	51	38	44	21
70	550+00	42 Lt.	1.0-2.0	Silty clay	A-7-6 (12)	0	4	61	35	42	19
71	574+00	42 Lt.	11.5-13.5	Clay	A-4 (6)	13	20	37	30	23	8
72	580+50	℄	0.0-1.5	Sandy loam	A-2-4 (0)	30	44	17	9	24	6
			7.5-9.0	Gravelly Sand	A-2-4 (0)	36	50	14		NP	NP
73	588+00	42 Rt.	6.0-8.0	Sandy loam	A-2-4 (0)	3	74	13	10	17	1
			8.0-10.0	Clay	A-6 (9)	5	17	38	40	28	12
74	594+00	42 Lt.	2.0-4.0	Silty clay	A-7-6 (16)	0	2	59	39	47	25
			4.0-6.0	Silty clay loam	A-6 (9)	4	21	55	20	30	13
75	611+00	42 Lt.	0.0-2.0	Silty clay loam	A-7-6 (12)	1	7	63	29	43	19
76	621+75	℄	5.0-6.0	Clay	A-6 (9)	8	20	42	30	32	14
77	647+00	42 Lt.	1.0-2.0	Silty clay	A-7-6 (15)	1	10	58	31	45	24

APPENDIX CONT'D.

SITE	STATION	OFFSET (ft.)	DEPTH (ft.)	TEXTURE	AASHO CLASS.	PERCENTAGE				LL	PI
						GRAVEL	SAND	SILT	CLAY		
78	659+50	42 Lt.	0.0-2.0	Silty clay loam	A-6 (9)	2	23	54	21	31	12
			2.0-11.0	Clay	A-7-6 (11)	4	28	33	35	41	21
			12.0-15.0	Clay loam	A-4 (5)	12	27	37	24	24	10
79	681 +00	℄	5.0-6.0	Gravelly sand	A-1-b (0)	47	41	- 1	2 -	NP	NP
80	681 + 60	42 Rt.	6.0-7.0	Sandy loam	A-2-4 (0)	20	55	18	7	27	9
			9.0-10.0	Gravelly sand	A-1-b (0)	34	51	- 1	5-		NP
81	685 +00	42 Lt.	0.0-2.0	Silty clay	A-7-6 (14)	0	7	58	35	48	22
82	704 + 90	42 Lt.	2.0-4.0	Clay	A-7-6 (18)	0	5	49	46	50	29
83	711 + 00	42 Lt.	12.5-13.5	Clay loam	A-4 (6)	4	30	38	28	21	9
84	716 + 00	42 Lt.	5.0-6.0	Sandy loam	A-4 (2)	14	42	27	17	24	8
85	729 + 50	42 Lt.	2.0-4.0	Silty clay loam	A-6 (11)	0	7	71	22	38	18
			8.0-9.0	Clay loam	A-4 (6)	6	29	40	25	25	10
86	844 + 75	42 Rt.	2.0-4.0	Clay loam	A-6 (6)	6	33	32	29	30	14
87	890 + 00	42 Rt.	5.0-6.0	Clay	A-4 (8)	3	12	45	40	28	10
			8.5-14.5	Clay loam	A-4 (8)	5	20	45	30	25	10
88	896 + 00	42 Rt.	0.0-0.5	Silty clay loam	A-7-6 (11)	0	10	66	24	42	16
			2.0-3.0	Silty clay	A-7-6 (17)	0	6	54	40	50	28
89	902 + 25	42 Rt.	0.5-1.5	Silty clay	A-7-6 (13)	7	9	53	31	45	20
90	909 + 50	42 Rt.	6.0-8.0	Clay loam	A-4 (6)	5	30	40	25	25	10

CORPS OF ENGINEERS,

U. S. ARMY



REVISION	DATE	DESCRIPTION	BY

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CORPS OF ENGINEERS
LOUISVILLE KENTUCKY

DESIGNED BY:
DRAWN BY:
TRACED BY:
CHECKED BY:
SUBMITTED:
APPROVED:
APPROVED:
APPROVED:

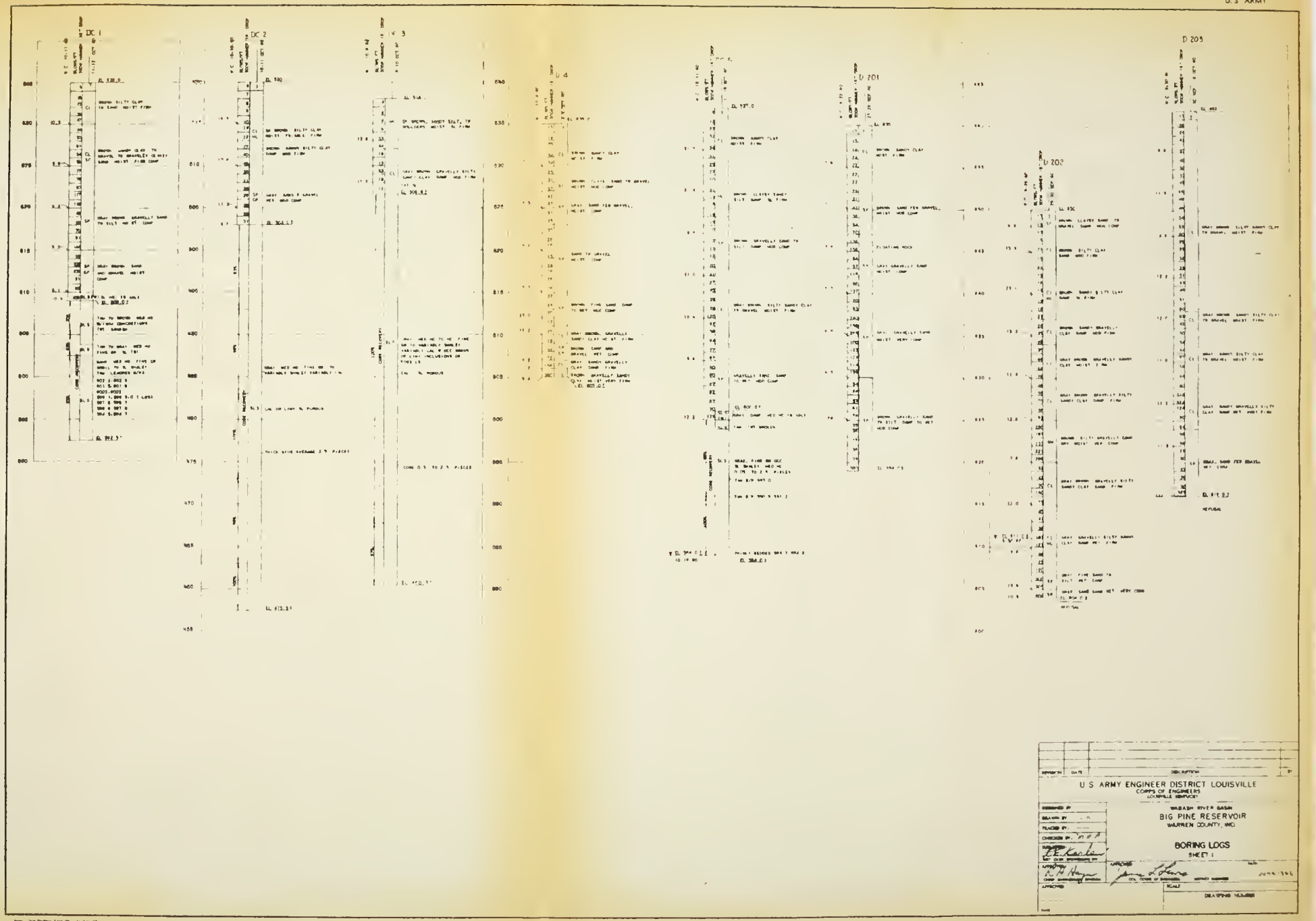
WABASH RIVER BASIN
BIG PINE RESERVOIR
WARREN COUNTY, IND

BORING LOGS
SHEET 1

DATE: JUNE 1966

SCALE:

DRAWING NUMBER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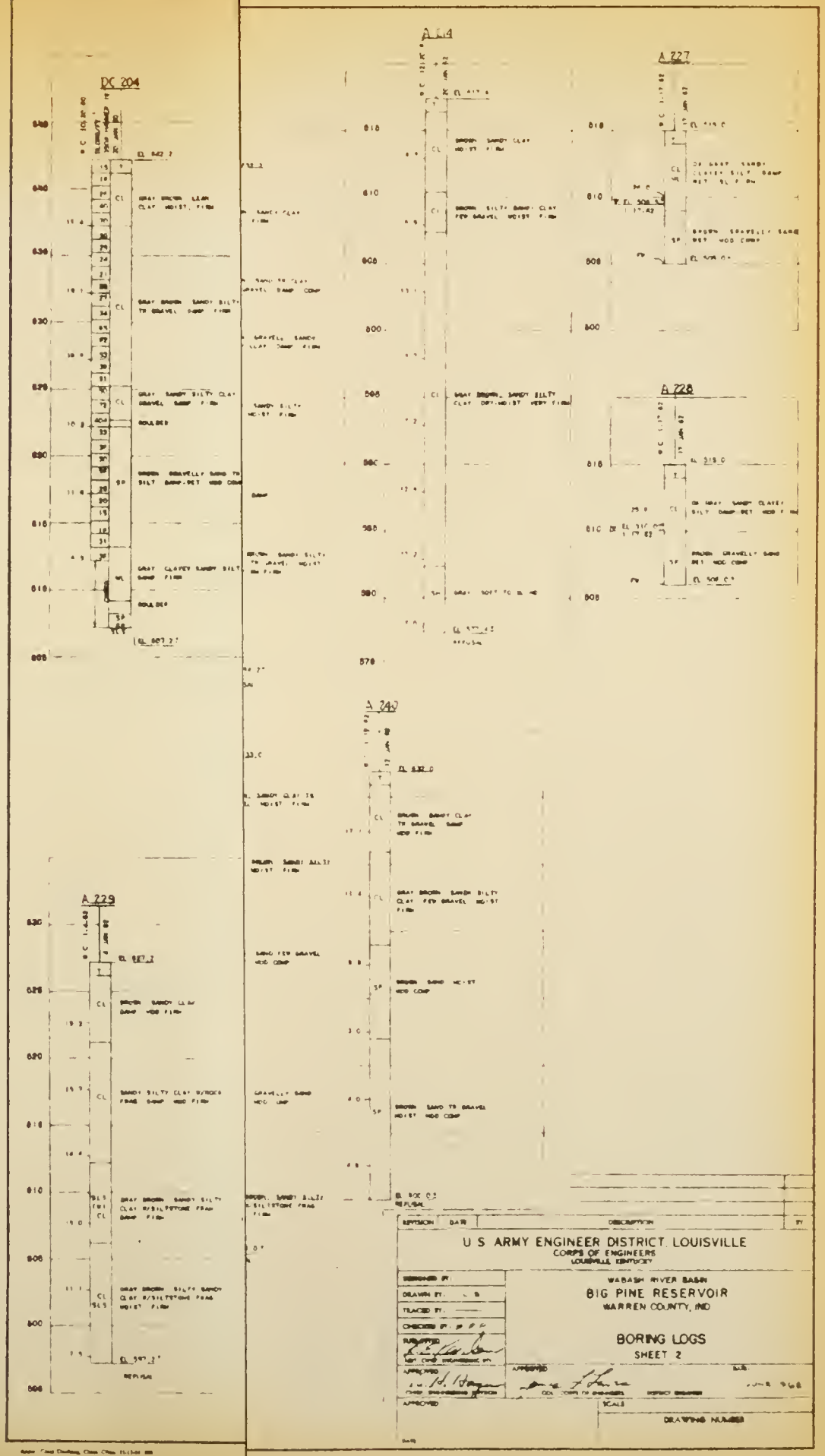
CORPS OF ENGINEERS
WABASH RIVER BASIN
BIG PINE RESERVOIR
WARREN COUNTY, IND.
BORING LOGS
SHEET 1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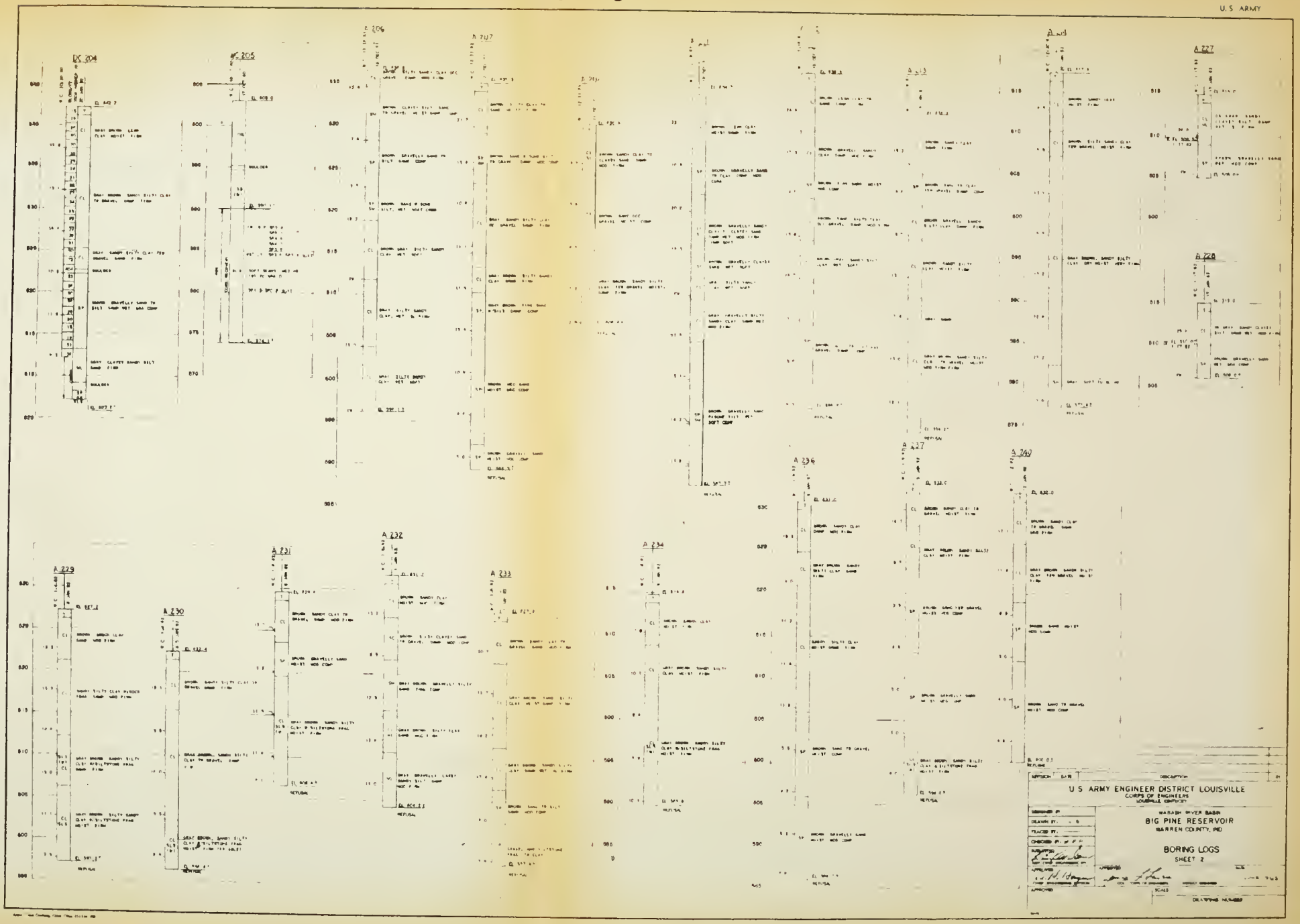
CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY
WABASH RIVER BASIN
BIG PINE RESERVOIR
WARREN COUNTY, IND
BORING LOGS
SHEET 2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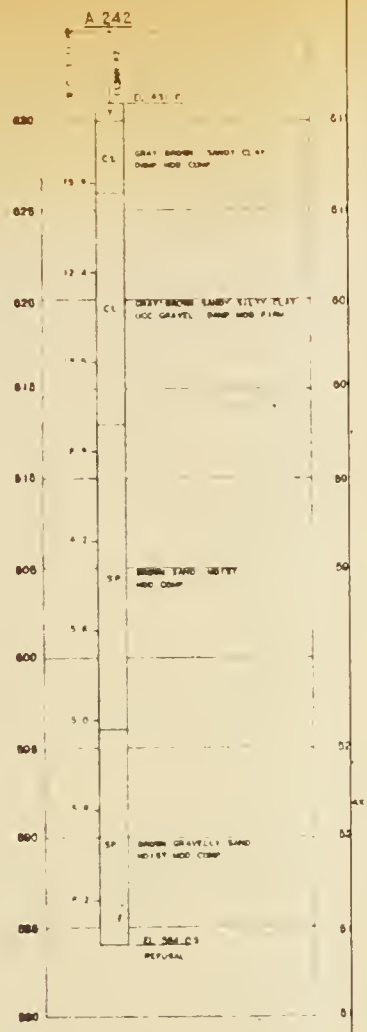
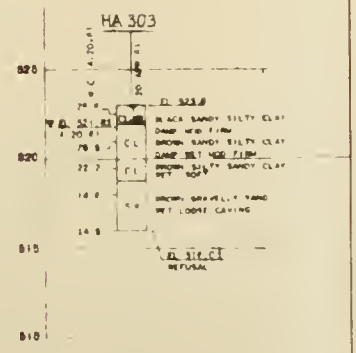
CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY
WABASH RIVER BASIN
BIG PINE RESERVOIR
WARREN COUNTY, IND
BORING LOGS
SHEET 2

CORPS OF ENGINEERS, U.S. ARMY





REVISION	DATE	DESCRIPTION	BY

U S ARMY ENGINEER DISTRICT LOUISVILLE
CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY

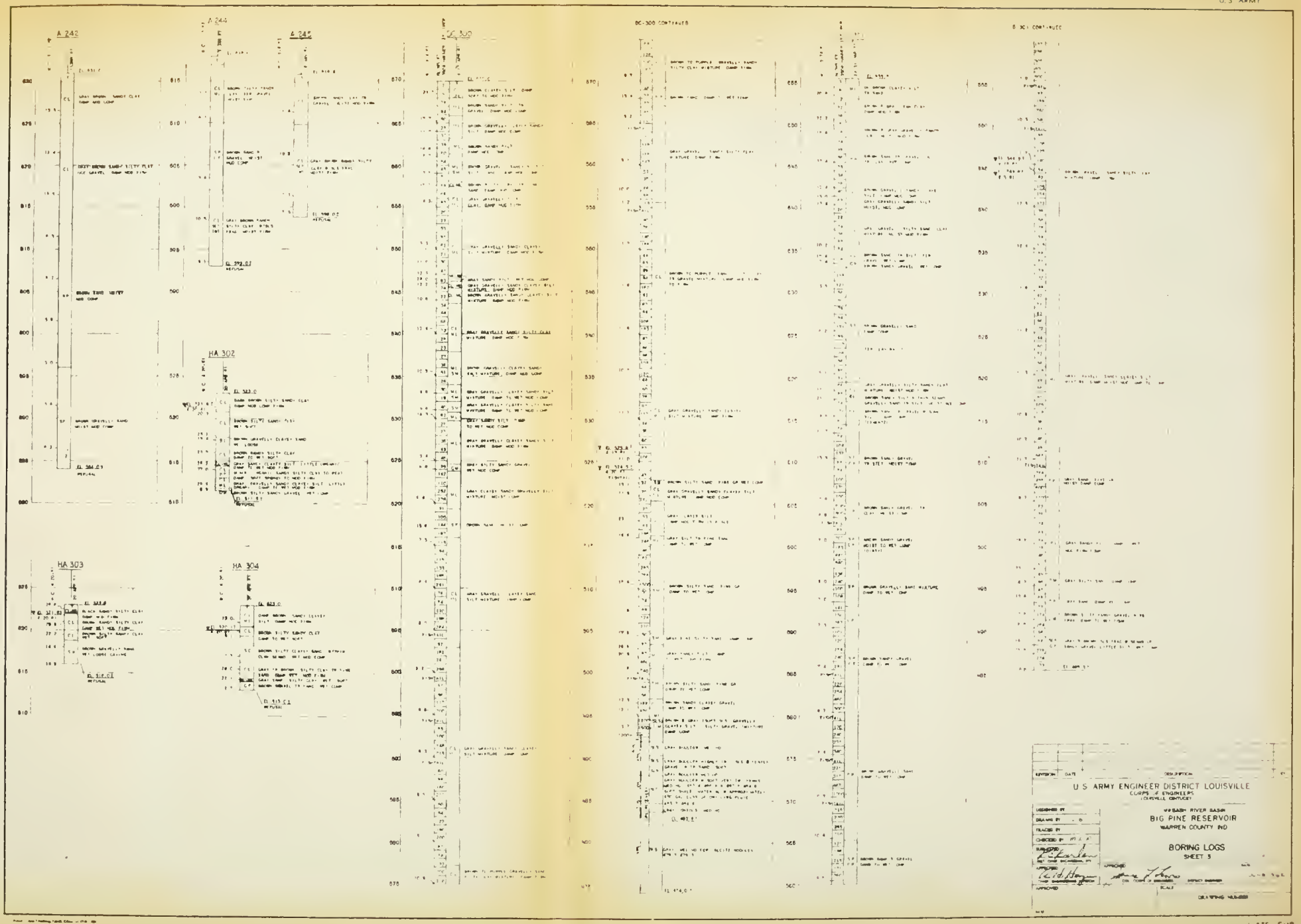
WABASH RIVER BASIN
BIG PINE RESERVOIR
WARREN COUNTY IND

BORING LOGS
SHEET 3

DESIGNED BY
DRAWN BY
TRACED BY
CHECKED BY
SUBMITTED
APPROVED
APPROVED
APPROVED

DATE: JUNE 1966

DRAWING NUMBER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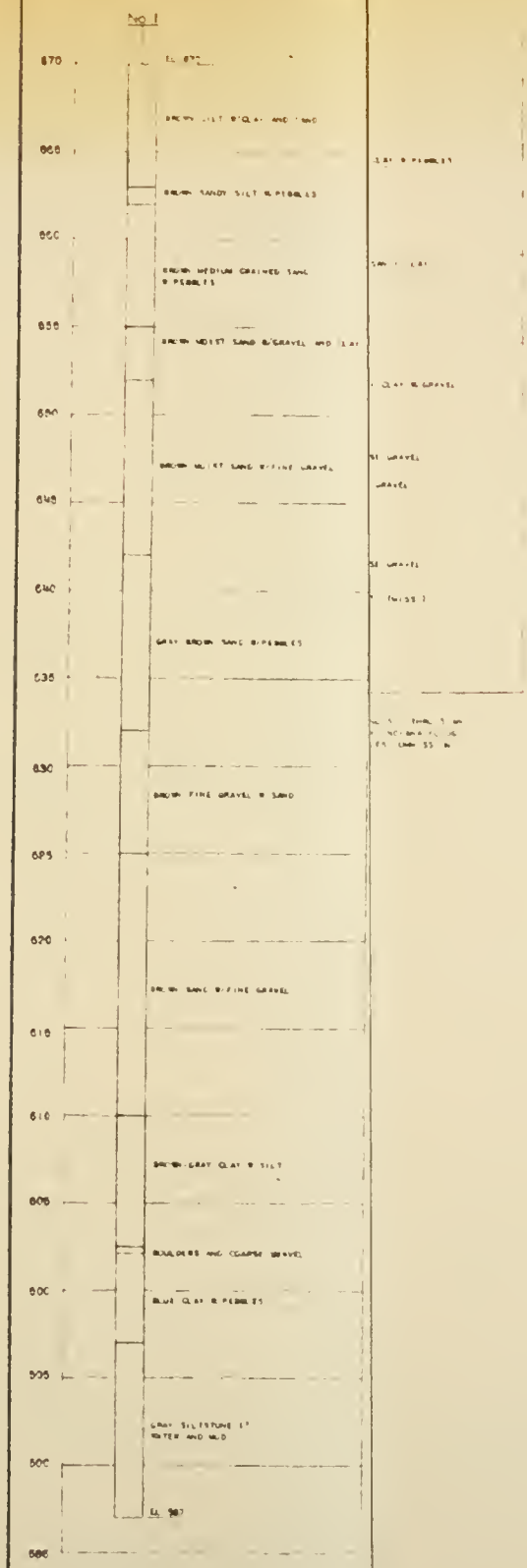
CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY
WABASH RIVER BASIN
BIG PINE RESERVOIR
WARREN COUNTY IND
BORING LOGS
SHEET 3

CORPS OF ENGINEERS.

U S ARMY



REVISION	DATE	DESCRIPTION	BY

U. S. ARMY ENGINEER DISTRICT, LOUISVILLE
CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY

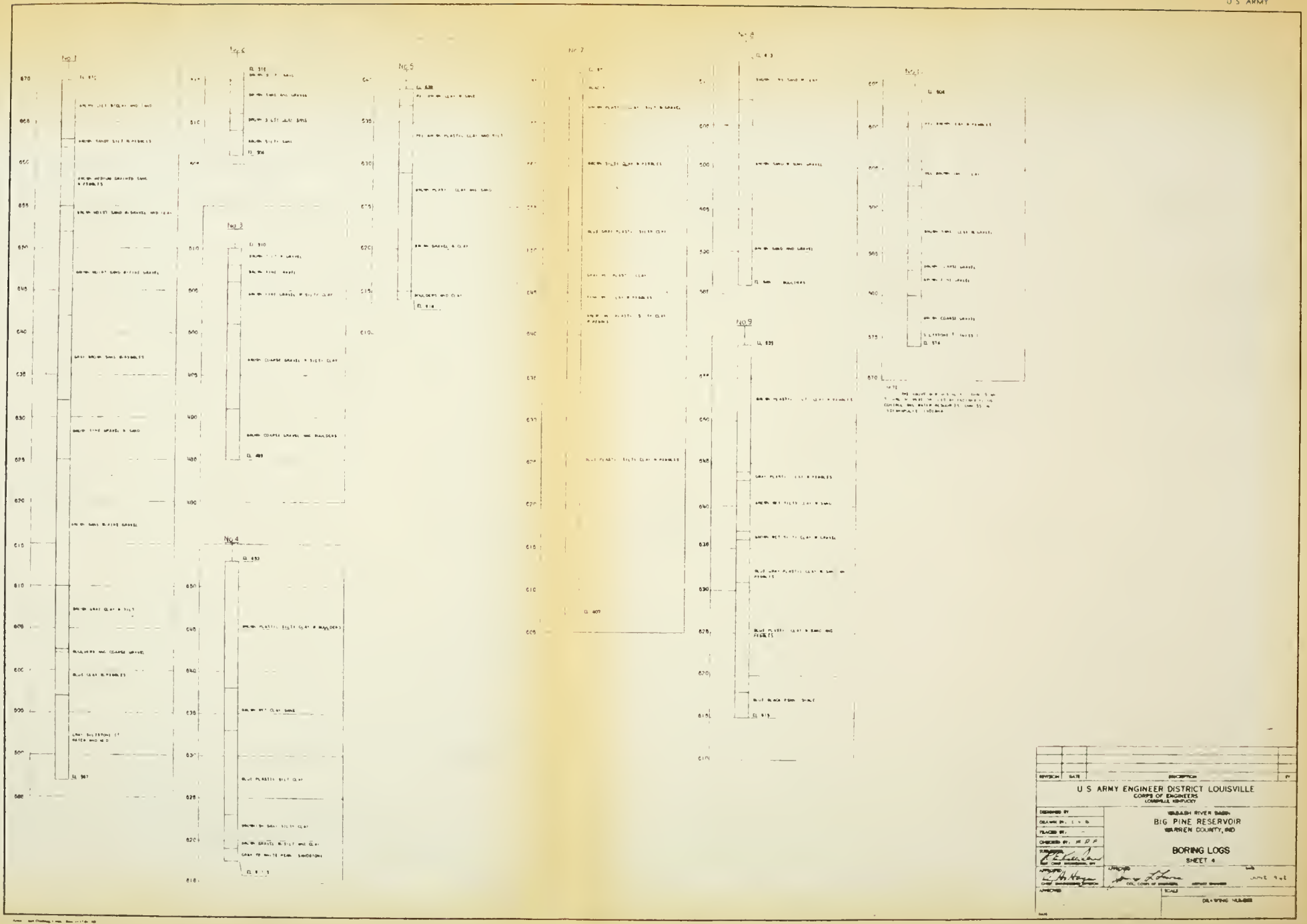
DESIGNED BY
DRAWN BY: C. L. D.
TRACED BY: —
CHECKED BY: M. D. P.
SUBMITTED: R. E. Kuehn
CHIEF, DESIGN BRANCH
APPROVED: C. H. Hayes
CHIEF, ENGINEERING DIVISION

WABASH RIVER BASIN
BIG PINE RESERVOIR
WARREN COUNTY, IND

BORING LOGS
SHEET 4

APPROVED: James L. Laurie
COL., CORPS OF ENGINEERS, DISTRICT ENGINEER
DATE: JUNE 1962

APPROVED
DATE
SCALE
DRAWING NUMBER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U S ARMY ENGINEER DISTRICT LOUISVILLE
CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY
WABASH RIVER BASIN
BIG PINE RESERVOIR
WARREN COUNTY, IND
BORING LOGS
SHEET 4

APPENDEX C

SOIL CLASSIFICATION AND PROFILE SYMBOLS

Description	Grain Size Distribution				Plastic Index	Symbol
	Gravel % Retained on #10	Sand #10-#200	Silt 0.05-0.005mm	Clay Less than 0.005mm		
Gravel	85-100	0-15	0-10	0-10	NP	
Sandy Gravel	50-85	15-50	0-10	0-10	6 Max.	
Sand	0-15	85-100	0-10	0-10	NP	
Gravelly Sand	20-49	45-85	0-10	0-10	6 Max.	
Sandy Loam	0-19	50-80	0-50	0-20	6 Max.	
Sandy Clay Loam	0-19	50-80	0-30	20-30	10 Max.	
Sandy Clay	0-19	55-70	0-15	30-45	11 Min.	
Loam	0-19	30-50	30-50	0-20	10 Max.	
Silt Loam	0-19	0-50	50-100	0-20	10 Max.	
Silty Clay Loam	0-19	0-30	70-100	20-30	11 Min.	
Silty Clay	0-19	0-15	55-70	30-45	11 Min.	
Clay Loam	0-19	20-50	50-80	20-30	11 Min.	
Clay	0-19	0-55	0-55	30-100	11 Min.	
Peat or Muck						
Limestone						
Sandstone						
Shale						
Stony Fragments						
Organic Matter						
Topsoil						

Classification of Gravelly Soils

85%-100% gravel plus finer material - Gravel
50%-84% gravel plus finer material - Clayey, silty or sandy gravel
20%-49% gravel plus finer material - Use fine classification and called gravelly sand, gravelly silt or gravelly clay
0%-19% gravel plus finer material - Use fine classification only

LEGEND

PARENT MATERIALS
(GROUPED ACCORDING TO LAND FORM AND ORIGIN)

- RIDGE MORAINE
- LOESS COVERED RIDGE MORAINE
- GROUND MORAINE
- LOESS COVERED GROUND MORAINE
- MORAINE ON BEDROCK
- SANDSTONE AND SHALE
- KAME
- OUTWASH PLAIN
- TERRACE
- TERRACE ON ROCK BENCHES
- FLOOD PLAIN
- SAND DUNE
- PEAT AND MUCK

MISCELLANEOUS

- HIGHLY ORGANIC TOPSOIL
- BOULDER BELT
- LAKE OR POND
- SOIL SAMPLING SITE
- QUARRY
- GRAVEL PIT

TEXTURAL SYMBOLS
(SUPERIMPOSED ON PARENT MATERIAL SYMBOLS TO SHOW RELATIVE COMPOSITION)

- GRAVEL
- SAND
- SILT
- CLAY

TEXTURAL SYMBOLS FOR SOIL PROFILES

- GRAVEL
- SAND
- SILT
- CLAY
- LOAM
- PEAT AND MUCK
- ORGANIC MATERIAL
- SANDSTONE
- SHALE
- STONE

ENGINEE

WARRE

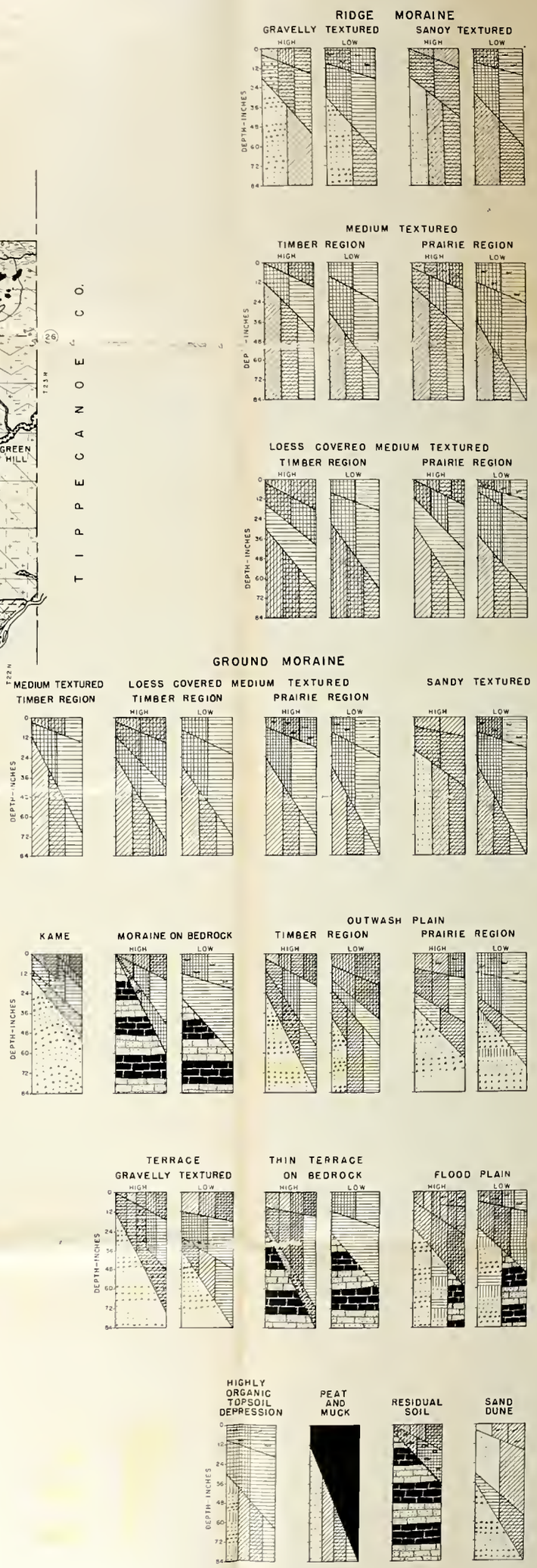
1950 A

JOINT HIGH

PURD

PREPARED UNDER THE SUPERVISION OF P. T. YEH

GENERAL SOIL PROFILES



ENGINEERING SOILS MAP
WARREN COUNTY
INDIANA

PREPARED FROM

1950 AAA AERIAL PHOTOGRAPHS

BY

JOINT HIGHWAY RESEARCH PROJECT

AT

PURDUE UNIVERSITY

1970

SCALE OF MILES

1 3/4 1/2 1/4 0 1 2 3 4

DRAWN BY D.J SHARP, T.H CHASTAIN, AND O. PIPER